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THE RATING OF ARC LAMPS.

The recent contest in Colorado Springs of which we give some account elsewhere was on its face a weird and wonderful anachronism. Nevertheless, it raised issues which in fact have at the present moment a high degree of pertinence. Though the questions there involved had their origin in the assumption of an old contract after a lapse of time so great as to span a complete change in the art, their character in view of present developments deserves comment. As to the facts in the case, there can be no doubt regarding what was meant by a 2,000 cp light in 1898. No arc save the regular open "full arc" could have been intended, since no other arc had been, was then or is now customarily denominated as "2,000 cp." Long prior to 1898 the fiction of an actual 2,000 cp had been laid aside, since no commercial arc had ever given that amount of light on any method of measurement. The much cited resolution of the National Electric Light Association in 1894 leaves no doubt upon that particular point, since its very purpose was to prevent this particular misunderstanding which had been the source of many litigations. The watt specification of this resolution was a sufficient definition so long as none but ordinary open arcs were in commercial use, since with such arcs the conditions of successful operation automatically limited the voltage at the arc, and consequently the current, so that a 450-watt arc could practically mean but one standard thing. The attempt to extend this specification into the present art is a curious evidence of the rapidity of changes in electrical practice, so that to those familiar with recent practice only, the issues of fifteen years ago are half understood and half forgotten.

This issue thus raised, however, is now a rather important one. Take, for example, the magnetite arc, which is beginning to replace the ordinary enclosed arc. Should it be rated in watts, on the same basis as an enclosed arc, or should it be rated on comparative candle power? Obviously a watt rating would be as unfair to the station as the watt rating on an alternating-current enclosed lamp is to the consumer. Shall it be rated on candlepower? Then it receives no credit for a distribution that is especially useful in street lighting. And if illumination is the thing and no attention is to be paid to watts or to absolute flux of light, then one plays directly into the hands of the Welsbach contingent. On a specification of minimum illumination only they can unquestionably beat out any arc system which the mind of man has not yet devised. The conspicuous failing of this system is inability to produce just that effect of brilliancy which in the arc is due to the total immense flux of light, and which makes the difference between good and poor street lighting. The German lighting engineers have tentatively adopted a mean lower hemispherical rating which probably defines the useful effect in street lighting better than any other—which is not saying much. A watt rating is plainly only possible in comparing arcs of the same kind, and with the large variety now being

introduced, is utterly valueless without other specification. A rating in terms of electrical units is, however, very valuable in that it allows tests to be made with comparative ease, which is not the case when either candlepower or its resultant illumination is the thing specified.

From an academic standpoint one could certainly undertake to deliver a specified m.l.h.c.p. or m.s.c.p., and knowing his lamps could live up to the contract. Since the advent of the sphere-photometer one can get fairly reliable results for these quantities, certainly better than for illumination, the measurement of which on the street involves all the difficulties of arc photometry besides some additional ones of its own. In point of fact the history of the art shows that neither candle-power nor watts has been the real basis of rating for street arcs. Certainly since the very early days no contract has been based on the actual candle-power delivered, nor have charges been made out on the basis of kilowatts furnished at the street lamps. In practically every case street lights have been sold as lights delivered by specified lamps and with service of a specified kind. And this, if the qualities implied are mutually understood by the contracting parties, is a perfectly fair method. One buys then, not x watts or y candlepower, but a particular service — an m ampere specified lamp, taking not less than n watts at the arc, and worked on, say, the Frund schedule. Not a scientific basis, we grant, but a very definite one, easily verified. If it becomes necessary or desirable to formulate a different scheme it strikes us that it might be worth while to consider a mean illumination, based on mean lower hemispherical cp, plus a specification of the minimum; i. e., the lamp should be required to give p mean foot-candles within a circle of given radius and not less than q foot-candle at the periphery thereof. Lacking the former specification, an arc lamp can be beaten out by tallow-dips, and lacking the latter, uneven lighting is at a premium. The coming into the art of the tribe of flaming arcs is bound to reopen the question of rating in very aggravated form. Neither watts nor real cp have ever practically been useful ratings in the actual framing of contracts for street lighting, and they are never likely to be unless qualified by many other considerations. The Colorado Springs incident is sufficient evidence of the unwisdom of making vague and indefinite contracts. Present conditions make the need of precise and carefully drawn specifications doubly important.

Resistivity Temperature Formulas for Copper.

There is scarcely any table or formula that electrical engineers use so much as the one which reduces the resistance of copper wires from one temperature to another. In order to apply Ohm's law to cases involving copper wires, their resistance has frequently to be corrected for temperature, and the error that may be introduced by neglecting this temperature correction may be considerable, as the ordinary overhead copper wire in summer time at a temperature of 30° C. possesses a resistance about 12.6 per cent greater than in winter time at a temperature of 0° C. All electrical tests of dynamo-machine performance have to be referred to a uniform temperature of reference, and require correction for temperature. In many tests of the heating of dynamos, the temperature elevation is determined by reference to the increase in resistance of certain copper-wire coils on the machine, and by means of an assumed temperature coefficient. The first scientific observer who measured and published the temperature coefficient of copper was Dr. Matthiessen, in England, about forty-five years ago. He measured the resistance offered by copper wires of an approved degree of chemical purity, when immersed in an oil bath at different successive temperatures. His formula for temperature correction was universally used for many years.

In the article by Dr. F. B. Crocker, on this subject at page 385 of this number, it is shown that there is considerable difference of usage at the present time among electrical engineers in regard to the temperature coefficient of copper. In Dr. Matthiessen's time, commercial copper was relatively impure by comparison with the metal used in the electric arts to-day, and although his report upon the research indicates that he used wires drawn from specially prepared electrolytically deposited copper, it is quite possible that his samples did not have precisely the same temperature-coefficient that is averaged by good commercial copper to-day. Numerous researches in recent years have shown that the resistivity of good copper follows a straight-line law with respect to temperature, so that equal increments of temperature are accompanied by equal increments of resistivity. There is, however, some little difference of opinion among different experimenters as to the slope of the straight line. Some take the slope as equal to 0.4 per cent of the resistivity at 0° C. per degree Centigrade, and others go as high as 0.428 per cent, a difference of 7 per cent. If then a coil of copper wire, tested initially at 0° C., was stated by an observer, using the first of these temperature-coefficients, to have increased, say, 50° C. in temperature, an observer using the second coefficient would declare the temperature elevation of the coil to be only 46.5° C. Such a discrepancy might cause a dynamo machine to be rejected in the one case, and accepted in the other.

The coefficient adopted within the last few years by the American Institute of Electrical Engineers is 0.42 per cent per degree Centigrade, based on the resistivity at 0° C. It is a matter of some importance that there should be an international agreement on this matter. The copper used in the electric arts probably does not have exactly the same temperature coefficient in different samples of one country, or in samples used in different countries, but it probably averages the same in all civilized countries. The same average should be accepted by all. At present the British favor 0.428, the Germans 0.4, the Americans 0.42, and the French have not perhaps officially pronounced. Dr. Crocker adds a series of curves to his article indicating the relative percentage of discrepancy in resistivity of copper, according to different rules in use, with reference to the resistivity at 0° C., and to the American Institute rule. We hope this matter may be satisfactorily dealt with by the international electrotechnical commission appointed by the various national electrical engineering societies.

Self-Regulating Alternators.

The direct-current generator has for many years been constructed in the form of a compound-wound machine, either simple-compound, or over-compounded. The alternating-current generator has indeed been compounded in a variety of ways, but never with the same success or convenience as in the case of direct-current machines. The result is that most alternators are separately excited and uncompounded machines. Moreover, it is well known that the problem of compounding

an alternator is much more difficult than that of compounding a direct-current generator. In order to maintain the voltage constant at the terminals of a direct-current generator, it is only necessary to compensate for the IR drop in the armature, which is in direct proportion to the load current. In the case of an alternator, however, it is necessary to compensate for the vector IZ drop in the armature, which depends not only upon the strength of the load current, but also upon its phase. A compounding or compensation which might keep the terminal voltage constant under a non-inductive load, might cause the terminal voltage to fall heavily under inductive load of the same number of amperes, or to rise markedly under anti-inductive load. Since the power factor of the load on a generator is likely to vary in practice within limits of 20 per cent or more, it is evident that no method of alternator compounding is reliable that only compensates correctly at one power factor.

Various plans have been suggested and used at different times for compounding alternators, in such a manner as automatically to compensate for changes both of load and of load power factor. Some of these methods have been rather complicated and expensive. Others have been fairly simple. Nevertheless, the automatically compounding alternator is still comparatively rare, especially in large sizes. Most of the methods that have been used involve operating upon the excitation of the alternator exciter. The method suggested by Mr. A. Heyland, as detailed in the article on page 386 this week, utilizes some interesting features. The alternator may be regarded as associating a unipolar exciter in the same structure as the multipolar rotor field machine. The unipolar direct-current exciter receives its excitation partly from a dissymmetry in the multipolar structure, and partly from the armature reaction of the alternator. The result is that, as the load increases, the magnetic flux diverted into the unipolar machine is increased, and with it the direct-current voltage generated by the unipolar machine is likewise increased. In the preferred form the increase of unipolar voltage increases the excitation of the exciter, and causes the latter to strengthen the main field of the alternator. The arrangement is such that the greater the lag of current supplied to the load of the alternator the greater will be the flux diverted into the magnetic circuit of the unipolar machine for the same alternating current strength delivered, and the greater the stimulus to the exciter, and, through the action of the latter, on the alternator field. The apparatus thus operates by using the distortion of the alternator field flux by the armature current. In other words, the armature reaction of the alternator is utilized. The generating apparatus may be regarded as virtually comprising two small direct-current generators, and one alternator. The first small direct-current generator is the usual exciter, operating on the field magnet of the alternator. The second is a small unipolar machine, incorporated with the alternator structure, and operating on the field of the exciter. It will be interesting to ascertain how the machine behaves in practice.

THE SEASON OF STATE LEGISLATION.

This is the time of year when many State legislatures are in session and central station owners are watching with apprehension the regular crop of good, bad and indifferent bills introduced to regulate public service companies. It might as well be recognized at the outset by central station men that legislation in the direction of regulating public service companies is almost certain to be passed in many States sooner or later in response to the present popular demand for the regulation of corporations. Whether it is needed or not, some kind of provision for either the regulation of rates or supervision by commissions is likely to be passed within the next two or three years by many of the State legislatures where such laws are not already in force. If central station companies are wise they will direct their efforts, not toward blindly opposing all kinds of legislation aimed at regulation, but to encouraging legislation which will accomplish the desired ends and work the least hardship upon the companies. By many central station men and lawyers who have given the matter considerable attention, the regulation of corporations as practiced in Massachusetts through commissions has had a most beneficial effect, both in safeguarding the interests of stockholders and of the public, and in preventing ill-advised municipal ownership undertakings. As a general proposition, a State commission is a much more competent and responsible body when it comes to deciding on reasonable rates, quality of service and necessity for enlargement of capital stock, than any city council. While it is conceivable that the Massachusetts plan might not work well with a corrupt or incompetent commission, as a matter of fact it seems always to have worked well in Massachusetts, where the grave responsibilities attached to the position of commissioner have tended to prevent the selection of political incompetents and grafters.

Two questions upon which there seems to be an unfortunate difference of opinion among central station owners at present are those relating to the proper method of regulation of electric light and power rates by local or State governments, and the advisability of legislation insuring uniform rates to similar classes of customers, without discrimination. As a matter of fact most companies are driven by natural business considerations and the competition of other illuminants to make their rates as low as they think they can without losing money. If a few corporations are short-sighted enough to keep their rates very high with the idea that they are thereby making more money, they are apt to be the principal losers. Such companies are, however, very few, but it is only right that there should be some method of dealing with them when the central station service of a community is unfortunately dependent upon them. The most progressive companies need no rate regulation. They are pushing their rates down as fast as the growth of the business and changes in the art will permit. As to legislation either State or municipal, providing that the companies' schedule of rates shall be published, and that no customer of a certain class shall get a better rate than any other customer of the same class, there is a decided difference of opinion among central station men, but the tendency of the times is toward the prevention of discrimination on the part of any public service company; and the sooner central station companies can get their matters in shape to accept the inevitable the better. Many companies now have complete published schedules of rates. As a matter of fact nothing does more to establish public confidence and satisfaction with a company than to know that all customers are treated alike, that any differences in rates between customers are simply due to differences in the kind of service required, and that every man can get the rates to which he is entitled under the schedule.

Watt vs. Candle-Power Rating of Arc Lamps.

An interesting arbitration proceeding involving the rating of arc lamps recently occurred at Colorado Springs, resulting from a difficulty of several years' standing between the City of Colorado Springs and the Pike's Peak Hydro-Electric Company. The historical facts are briefly these. In 1898 the city was being lighted by the Colorado Springs Electric Lighting Company, the lamps in use being the regular 9.6 ampere arcs. But a franchise was at that time granted to one Jackson for the use of the city water system for power purposes, the considerations including certain hydraulic work for the water system and an agreement to furnish "lights of standard 2,000 candlepower" at $5.50 per month. After 25 years the plant was to revert to the city. But action under this franchise being delayed, the Colorado Springs Electric Company continued to give service as *ad interim* contractor.

In 1901 this company changed its system to the 6.6 amp. alternating-current enclosed arc with a substantial reduction in price to about $80 per year. Under its contract its service would cease automatically, whenever the Jackson franchise was ready to take up its work. Now this Jackson franchise came into the possession of the Pike's Peak Hydro-Electric Company, but, instead of going ahead and building a system as was expected, that company built its plant and put in its 6,600-volt line entirely off city property and then made a contract with the Colorado Springs Electric Company to take over its output at about 0.6 cent per kw-hour and to assume the work of lighting the city in fact, although in law the work was being performed by, and the bills were paid to the Pikes Peak Company. A suit followed, the city alleging that the Pikes Peak Company was thus dodging its obligations regarding establishing a system, which suit the electric company won on the ground that it was free to employ an agent if it wanted to. Meanwhile service was continued on city lamps as before and a series of disputes followed, partly with respect to the use of the water and later as regards the quality of the lights. These particular lamps had not been formally accepted by the city, which in all documents reserved to itself its rights under the Jackson franchise, but service had gone on and had been increased with the existing 6.6 amp. alternating arcs. Meanwhile the Pikes Peak Company and the Colorado Springs Company had fallen under virtually the same ownership and during this process of absorption it came out that the latter was buying its power at 0.6 cent per kw-hour and retailing it at about 12 cents, which threw oil on the flames.

Finally, the matter of the lights furnished came to a crisis and the city demanded that the lights required by the Jackson franchise be furnished and damages for the deficit in light be paid. After long discussion, an agreement of arbitration was signed, which in terms specified that any deficit of the service given should be measured in *candlepower*. Under the Colorado statutes, a Board of Arbitration has large power, is judge of both the law and the facts, and, on the issues stipulated, its decision is practically final. After much discussion the board was constituted as follows: The Pikes Peak Company nominated Mr. E. L. Elliott of New York, the city Mr. Henry Floy of New York, and the third arbiter was agreed to be Prof. Carpenter of Fort Collins, widely known as an engineer of distinguished ability. The experts summoned to the city were Mr. L. B. Marks of New York, Prof. Matthews of Purdue University, Prof. Shedd of Colorado College, and Mr. Alton D. Adams and Dr. Louis Bell of Boston. Those for the Pikes Peaw Company were Mr. W. D'A. Ryan of the General Electric Co., Mr. Schuchardt of the Chicago Edison Company, and Mr. Humphrey of the Denver Gas & Electric Co.

On Feb. 1 the board began its hearings, which lasted on long hours for more than a week. They were strenuous but characterized by the utmost good feeling, all hands seeming to grasp the humorous phases of the case. Technically the situation was curious as involving a contract made in good faith in the days of the open arc and delayed in its fulfillment not only until the rise of the enclosed arc to the rank of standard practice, but to the time of its threatened decline in view of the luminous and flaming arcs now coming into use. The technical questions involved were two: (1) What was a "standard arc light of 2,000 cp" in the latter part of 1898; and (2) What is an equitable ratio between this (whatever it was) and the 6.6 alternating arc supplied by the Pikes Peak Company from the time it began the supply of light at the price named in the Jackson franchise? As a matter of fact, the Pikes Peak Company raised the current in its lamps to 7 amperes in May last and in August last raised its voltage so as to give about 450 watts at the arc.

The one technical point on which all the experts fully agreed was that the regular 6.6-amp. alternating arc taking about 400 watts at the arc and about 427 at the lamp terminals was not a proper substitute for the lamp of the franchise under any definition. The contention of the city was that the standard 2,000-cp lamp of 1898 was the 9.6-amp. open arc consuming about 48 volts or 450 mean watts, the enclosed series systems being then only in tentative use and not customarily rated in cp at all, but specified as what they were. The defence, without denying that this was the usual lamp of the period, took the attitude that under the N. E. L. A. resolution of 1894, any lamp, whatever the amount or kind of current, which consumed at the arc 450 watts, was a 2,000-cp arc within the meaning of the Jackson franchise. Of course, the experts for the city denied this purport of the resolution considering the date of its making, and its validity in establishing standard nomenclature in face of the facts in any case. Obviously the watt rating if it were established would lead first to the conclusion that the service since August last met the terms of the franchise, and second, that for failure of previous service the Pikes Peak Company could be liable only for the deficit in watts in a comparatively small sum. The experts for the city held that under the agreement of arbitration, and in fact, any failure of service, should be reckoned on the deficit of effective light, on the basis of maximum mean spherical or other candlepower as the board should determine, but in no case in watts, candlepower not being proportional to watts save in a narrow range and in one kind of lamp. This led to a protracted wrangle over arc photometry in which the two groups of experts failed to come to any substantial agreement. Experts for the Pikes Peak Company insisted that a 7-amp. lamp at 450 watts, was the full equivalent of the lamp of the franchise, while those for the city held that it certainly was not, even the 7.5-amp. alternating lamp being scant for the purpose in point of candlepower really delivered, however good it might be in other respects.

The unfortunate part of the struggle is that in view of the law points the technical ones may never be passed on. Here the Pikes Peak Company set up the defence that the city had actually accepted the existing lamps, or failing this had so far assented to their use that the doctrine of equitable estoppal would apply. To this the city replied that no private agreement, if it had existed, could change the legal force of an ordinance, and second, that in fact in its documentary relations with the company, all rights under the Jackson franchise had been specifically reserved. Finally after the closure of the case the attorney for the defence, rising to a question of personal privilege, claimed that in the agreement of arbitration the clause which in terms required the settlement to be in candlepower was, in fact, only a claim of the city and without binding force upon them. The response was the legal principle that prior oral contentions cannot alter the force of the resulting documentary evidence. At about this point the Board of Arbitration went into a daze and at last accounts was wondering where it might be at. It is quite safe to say that the issue to be decided is a most tangled one for even a board of experts to decide. The pity is that it will really turn upon law points and many of the technical points will be left hanging in the air. The one technical matter practically settled in any event is a denial of the right of the 6.6-amp. alternating series arc at its regular rating to pose as of 2,000 cp lamp. The moral of the

whole matter is the unwisdom of making lighting contracts without an unequivocal specification of the thing to be furnished.

A telegram received from the *Evening Telegraph* of Colorado Springs as we go to press states that since the close of the arbitration hearing nothing has been done by the Board, though the individual members are said to be considering the evidence. A meeting is announced for early next week in Chicago, when the legal question of whether or not the city is stopped from asking damages because of its agreement to the substitution of the enclosed for the old form of arc lamps. Should it be decided that there is no estoppal, the Board will pronounce on the city's contention that candle-power is the proper measure of light and will fix the amount, if any, due to the city because of the substitution of the enclosed arc with its low candle-power for the open arc.

February Meeting, Chicago Section of Illuminating Engineering Society.

The February meeting of the Chicago section of the Illuminating Engineering Society was held February 14. Dinner was taken at White's Restaurant and the company then adjourned to the meeting room of the Chicago Edison Company across the street, where a stereopticon was available for presenting illustrations of examples of lighting. The subject was "Fixture Design and Location for Residence Lighting."

Mr. R. C. Spencer, of the firm of Spencer & Powers, architects, led the discussion, presenting a number of pictures of lighting fixtures in houses which he had designed. He stated at the outset that he considered one of the greatest errors that had been made in fixture design for electric light was the blind following of traditional forms of fixtures used with gas. With gas, pipes were necessary, which necessitated certain features on every gas fixture. With electricity there was no such restriction. He then showed lantern slides from photographs of a number of fixtures and rooms. Several of these fixtures were of the box lantern type with art glass sides. He also showed an inexpensive arrangement for lighting a shaving mirror in a bath-room with a lamp adjustable in height on each side of the mirror. The lamps were on drop cords supported from wooden brackets projecting from the picture molding. Another handsome fixture shown was a Japanese design box fixture for the newel post on a stairway. He did not, in general, favor too much of an attempt to conceal lighting fixtures and appliances or any other kind of mechanical appliances such as radiators, which are necessary to the equipment of a house. He showed a scheme of lighting for a living-room, consisting of square bell-shaped art glass shades placed over lamps, one lamp being placed over each corner of the living-room. He thought this better than one central chandelier for a living-room and most of the following speakers agreed with him. Concealed cornice or cove lighting had not proved economical enough to be practical.

Mr. H. K. Holsman, architect, described some unsuccessful attempts at concealed cove lighting. The light brought out the imperfections in the ceiling plastering too much. He did not favor concealed or indirect lighting because it produces an unnatural, shadowless light. We are accustomed to have lighting coming from definite sources which produce more or less shadow. If there are no shadows the effect is unnatural and almost ghastly. People do not like light coming from "nowhere in particular."

Mr. J. R. Cravath said that the art glass box and bell types of fixtures had a great application in good illuminating engineering because with the art glass sides of these boxes and bells the light can be shaded from the eye and inside of the fixtures the proper opal or prismatic reflectors can be used to give the desired distribution of light under the fixture.

Instruction for Shop Apprentices.

In order that its apprentice corps, which now consists of about 40 college graduates, may become properly trained in the work conducted by the company, and may thus furnish the best of material for its future engineers and engineering salesmen, the Allis-Chalmers Company has inaugurated at its West Allis factory a course of post-graduate lectures by its engineers. It is the expectation to provide for the apprentices and engineers of the company at least one lecture per month by an expert in the particular line discussed.

On the evening of February 14 Mr. W. F. Uhl gave an illustrated talk on hydraulic turbines, in which the history of the development of hydraulic turbines was outlined. The lecturer showed to what extent the complex laws of the flow of water may be modified and simplified so as to render them easily applicable to the practical design of a wheel for a specific duty.

The lecture was held in the spacious dining-room of the Allis-Chalmers Club, which has been arranged with special reference to such lectures. The club itself is an organization whose membership consists of the office employes, engineers and shop foremen, and was formed for the purpose of mutually contributing to the social welfare of the men and thereby of improving the "team work" of the engineers and the men with whom they come in contact. By thus encouraging the older practicing engineers, and the younger men who expected later to work with them or take their places, the company has been laying a foundation upon which is being built loyalty of a nature such as cannot be obtained by any other means.

Meeting of the Purdue Branch of the Institute.

The regular meeting of the Purdue Branch of the American Institute of Electrical Engineers, held Tuesday evening, Feb. 5, in the new lecture room of the Electrical Building, was called to order by Vice-Chairman G. B. Walker, who introduced the speaker of the evening, Mr. C. E. Hansell. The subject taken up was, "A Discussion of Hydro-Electric Plants and Their Development." Mr. Hansell said in part as follows: "The rapid development of hydro-electric plants is comparatively recent. At the Centennial Exposition at Philadelphia there was a small electrical showing indeed, especially when viewed from the standpoint of power transmission. A single Gramme ring dynamo was to be seen lighting a single arc lamp, and another Gramme ring machine was used to run a small motor stationed a few feet away. The mechanical energy given up by the motor was used to pump a small supply of water. From these small beginnings our magnificent transmission plants have been developed.

"Dating from this exposition there are three important steps. First, the Laurenceburg experiments conducted by the Westinghouse Company. These experiments were conducted for the purpose of demonstrating the feasibility of electric lighting over what was then deemed a long distance (two miles). The experiments were conducted in 1886. Second, the invention of the polyphase induction motor by Tesla, and, third, the invention of the Shallenberger meter. These three events form the basis of our long distance transmission development. The Niagara power plant was built in 1893. In 1895, there were 75 hydro-electric plants. In 1902, there were 1,390 plants having a combined capacity of 438,472 horse-power, or about 315 hp per plant. Most of these plants are located in the Western States, largely because better water supply is available."

A discussion of the factors affecting the location, design and operation of hydro-electric plants in general was then taken up. A plant for the Wild-Cat River designed for university thesis work last year was used as a basis and the different considerations entering into the selection of site, etc., were taken up, also the marketing of the power obtained and the cost of power to producer and consumer, allowing a fair rate of profit.

Death of James Blake Cahoon.

We regret to report the death of Mr. James Blake Cahoon, ex-president of the National Electric Light Association, which occurred at New Rochelle, Sunday, February 17.

Mr. Cahoon was born at Lynden, Vt., in 1859, and entered the U. S. Naval Academy as a cadet-midshipman in 1875, graduating in 1879 No. 18 in a class of 41. After considerable sea service Ensign Cahoon was detailed to electrical work at the Newport, R. I., naval station, and while on duty there his sight was so injured while making tests of arc lamps that he was placed on the retired list in 1889 with the rank of Ensign. In the same year he became connected with the Thomson-Houston Company, among his first work being the organization of the Lynn offices. Upon the consolidation which gave rise to the General Electric Company, Mr. Cahoon organized the expert department at the Schenectady works, and later became chief engineer of the local companies committee, in which capacity he had at different times supervision of 39 lighting and street railway properties then owned by the General Electric Company.

In 1895 he resigned from that company to become general

JAMES BLAKE CAHOON.

manager of the Elmira Municipal Improvement Company, which operated the electric light, railway, gas and water plants of that city. In 1899 he left Elmira to accept the position of general manager of the Syracuse Electric Wiring Company, which had just obtained an electric light franchise in that city. In 1900 he was elected president of the National Electric Light Association at its Chicago meeting. During his incumbency of this office, Mr. Cahoon inaugurated new methods which at once had a great effect on the growth of the Association, then in a languishing condition, and largely led to its present prosperous condition.

Mr. Cahoon was one of the earliest to recognize the importance of close accounting in the management of electrical properties, and the analysis of data thus gathered with the view to improving economy of operation. On this subject he contributed a number of articles to the technical press and presented several papers before electric light associations.

Of recent years Mr. Cahoon has been frequently employed by banking houses and other financial interests to make reports on electrical properties. At the time of his death he was vice-president and consulting engineer of the Eldenbel Construction Co., of New York. Mr. Cahoon had a geniality of disposition and a sympathetic nature which endeared him to a wide circle of friends, who will feel his loss deeply.

Cornell Meeting of the Institute.

The regular monthly meeting of the Cornell University Branch of the American Institute of Electrical Engineers was held in Franklin Hall on the evening of Feb. 8. The paper by Messrs. Stillwell and Putnam on "The Substitution of Electric Motors for the Steam Locomotive" was abstracted and discussed. Messrs. R. L. Stone, W. C. Kennedy, W. H. Balcke and W. G. Taylor presented the four sections of the paper respectively. Through the courtesy of the New York office, the branch had the benefit of the discussion at New York, and this was abstracted by Prof. G. S. Macomber. After a general discussion, Prof. H. Wade Hibbard, head of the Railway Mechanical Engineering Department of Sibley College, presented the subject from the steam engineer's standpoint.

The interest in the meeting was intense as was shown by the large attendance, numbering 214. A business meeting preceded the presentation of the paper and the matter of the wearing of a badge by enrolled students was discussed. By an almost unanimous vote it was decided that the C. U. Branch does not favor the wearing of a badge by enrolled students. Another important item of business was the election of a student associate to the local executive committee. It was the desire of the executive committee to have the enrolled students recognized officially and they were asked to select from among the associates a person who could present their interests at meetings of the committee.

The local branch continues to grow at a healthy rate and now numbers approximately 110 members, associates and students. It occupies a well established position in the community and meets a definite need. It is as much social as technical.

At the next meeting which will be held on March 1st it is expected that Mr. J. S. Codman of the Schenectady Branch will present a paper on the general topic, "Charging for Electricity." Mr. Codman will give the branch the benefit of his experience on maximum demand indicators and allied subjects.

City Coal and Gas Consumption.

The relative consumption of coal and gas in the larger cities of the United States is furnished in a recent issue of the *Stevens' Indicator*, which shows New York to lead with an annual consumption of 12,500,000 tons of coal, followed by Chicago with 8,245,000 tons. As to gas, New York (Manhattan and Bronx only) consumes 21,000,000,000 cu. ft., and Chicago 12,000,000,000. The per capita consumption for six cities was given as follows:

City.	Population.	Coal, net tons.	Gas, cubic feet.
New York	4,014,000	3.12	8,800
Chicago	2,020,000	4.00	5,940
St. Louis	714,600	7.55	5,600
Boston	602,500	6.70	5,120
Cleveland	465,000	5.43	3,230
Cincinnati	425,000	8.20	5,180
Average	1,374,000	4.42	7,017

Of the total coal burned in these six cities, aggregating 36,428,000 tons, no less than 23,588,000 was bituminous, while the anthracite amounted to 12,840,000 tons (2,000 lb. each). The anthracite percentage was about 35. In the several cities the anthracite percentages were as follows: New York, 72; Chicago, 17; St. Louis, 3; Boston, 45; Cleveland, 13; Cincinnati, 1. Compared with the bituminous tonnage used in New York, 3,500,000 tons, Cincinnati used almost identically the same; St. Louis, 50 per cent more, and Chicago, 95 per cent more. The low consumption of coal in New York, per capita, with correspondingly high consumption of gas, is accounted for partly by congested population, which tends to increase the number of apartment houses and hotels, where many families are supplied with heat from a single central plant, and where a large share of the cooking is done by gas ranges, and partly because

the city is so pre-eminently a commercial one, rather than strictly a manufacturing community, as is so largely the case with the others.

New Type of Glower Lamp.

A patent issued Feb. 12 to Mr. Orlando M. Thowless describes a type of glower lamp consisting of a mixture of conducting and non-conducting material, covered, with the exception of the parts necessary for the conduction of the source of current, by a body of material which, though normally non-conductive, becomes conductive when subjected to the action of an electric current. The inner portion, or heating body, is composed of 80 parts of a conductor such as a metallic oxide, and 20 parts of a non-conductor such as magnesia. The outer portion of the glower is made by taking one or more of the refractory oxides and incorporating therewith a small quantity of easily fusible material, like borax or cryolite. This latter material is then formed into hollow cylinders, the interiors of which are filled in with the heating material.

Neutralizing Static Electricity.

A patent granted February 12 to William H. Chapman, Portland, Me., describes a process for neutralizing static electricity, generated in textile looms. This consists in placing charged electrical conductors some distance from the fabric being woven, and then passing a current of air over the conductor, which current impinges on the fabric. As illustrated, a piece of loosely woven wire netting is interposed between the fabric and a rotary blower. The wires may be kept charged by a static machine or by an alternator giving a high voltage and having its charges partially or wholly commutated so that for the most or the whole of the time the polarity will be opposite to that of the material under treatment. Good results are obtained with an alternation in which the prevailing polarity is three times that of the lesser. It is not necessary for the air blast to have any considerable velocity, as a gentle movement of the air through the wire netting will answer the purpose.

CURRENT NEWS AND NOTES.

SOUTHERN CONVENTION.—It has been decided by the executive committee of the Southwestern Electrical & Gas Association to hold the next annual convention at San Antonio, Texas, on May 14, 15 and 16. No details have yet been arranged as to programme. Mr. R. B. Stichter, Dallas, is secretary.

THE INTERCITY VIADUCT just opened at Kansas City, Mo., is 1¾ miles long, and is illuminated by about 1,000 incandescent lamps in globes on posts 24 feet apart. Tantalum lamps are used, this being, it is said, their first employment in highway lighting. The lighting was designed by Mr. E. R. Weeks with an eye to decorative effect and it is described as very fine.

GRIP ON BROOKLYN RAPID TRANSIT.—It is stated by an official of the Brooklyn Rapid Transit Company that 2,000 out of the 12,000 employees of the company are laid up with grip, pneumonia, and other ailments as a result of exposure to the severe weather of the past three weeks. The service, it is stated, is crippled somewhat on account of this condition of things.

WESTERN SOCIETY OF ENGINEERS.—The electrical section of the Western Society of Engineers at its regular meeting, February 18, heard an address by Mr. H. M. Biebel, of the Western Electric Company, on "Direct-Current Compensators for Balancing Electric Circuits." The several methods of connecting compensators were illustrated by diagrams and in the discussion which followed, considerable interest was displayed in the three-wire dynamo for supplying three-wire systems without compensators.

ELECTRIC RAILWAY DISASTER.—On Saturday afternoon, February 16, one of the new electric trains on the Brewsters division of the New York Central, left the track near Bronx Park, at a curve. There were four cars in the train, including two motor cars. Just what happened is still in doubt, but the resulting wreck was severe, while 21 passengers were killed and over 150 injured. The State Railway Commission is investigating the occurrence.

ARC LAMP CANDLEPOWER.—During the recent arbitration proceedings at Colorado Springs, Col., involving the rating and candlepower of arc lamps, the following figures were submitted by experts for the city: 9.6 amp., direct-current series open arc, maximum cp, 1,200; mean hemispherical cp, 500 to 700; mean spherical cp, 400 to 450. 6.6 amp., alternating-current series enclosed arc, with shade and clear globe, maximum cp, 400; mean hemispherical cp, 300; mean spherical cp, 150.

INSTITUTE MEETING.—The 215th meeting of the American Institute of Electrical Engineers will be held in the Auditorium of the Engineers' Building, 33 West Thirty-ninth Street, New York City, on Friday, March 1, at 8 o'clock p.m. The following papers will be presented and discussed: "Alternating-Current Electrolysis," by J. L. R. Hayden, of Schenectady; "Electrolytic Corrosion of Iron and Steel in Concrete," by A. A. Knudson, of New York; "Some Theoretical Notes on the Reduction of Earth Currents from Electric Railway Systems by Means of Negative Feeders," by George I. Rhodes, of New York.

STATE POSITIONS.—The New York State Civil Service Commission will hold examinations in all parts of the State February 23, 1907, for the following positions, among others: Assistant electrical engineer, $600 to $900 and maintenance; assistant steam engineer, $600 to $900 and maintenance; bridge draughtsman, $1,200 to $1,500. The last day for filing applications for these positions is February 18. The Commission has been unable to secure a sufficient number of eligibles for bridge draughtsman and assistant steam engineer, and qualified applicants for these positions have excellent chance of appointment. Full information and application forms for any of these examinations may be obtained by addressing the chief examiner of the Commission at Albany. Mr. Charles S. Fowler is chief examiner.

ELECTRICITY AND FIRES.—The National Electric Light Association appointed a committee last year on the "Fire Hazard of Electricity," this committee being instructed to investigate the subject with a view of determining whether the general impression that electricity is a relatively serious fire hazard which the public gets from the widely circulated quarterly reports on fire losses caused by electricity, and the general custom of the public press to attribute fires of mysterious origin to electrical causes, is justified by the facts. This committee brought in a report at the annual meeting of last year, which report is now in the proceedings of the N. E. L. A. A new committee has been appointed to bring in a report at the coming annual meeting. This committee desires to get an expression on several questions and to formulate the answers into a report which will be a fair indication of the status of the subject throughout the United States. The committee also proposes to supplement the statistics given in last year's report by bringing them up to date. In order to facilitate the work of this committee, a prompt answer to the questions will be greatly appreciated by its chairman, Mr. C. E. Skinner, Westinghouse Electric & Manufacturing Company, East Pittsburg, who desires that all returns shall be in by March 10.

MUST DROP STEAM.—A favorable report has been made by the U. S. Senate committee on the District of Columbia, on the bill requiring steam roads entering Washington to comply with the local smoke law or electrify their terminals. The railroads heretofore have said that they could not comply without electrifying, which would cost $5,000,000. This bill involves terminal electrification therefore, as in New York city.

A LIMITED PROGRAMME.—Last week, the socialist candidate for the Battersea district for the London County Council issued his address of appeal to the voters. He advocates municipal omnibuses, bakeries, dairies, milk and coal depots, markets for fish, meat and vegetables, pawnshops, restaurants and saloons; public ownership of hospitals and dispensaries, a county council bank, a municipal theater, a municipal opera house, work for the unemployed at trades' union wages, and a forty-eight-hour week for all employees. That is all he can think of at present, but he has other ideas coming.

TELEGRAPH INVESTIGATION.—The Interstate Commerce Commission is to investigate the relations between the Western Union and the Postal Telegraph companies and packing houses, grain firms and other business houses which have had special telegraph wires and operators furnished without leases. All through wires of this description have been discontinued and only "pony" wires running into the main telegraph offices left. The operators manning these wires from the packing house ends are now employed by the packing houses and not by the telegraph companies. The Interstate Commerce Commission is said to have taken the position that furnishing these large customers of the telegraph companies with facilities denied the small customers is in fact, a discrimination.

WIRELESS IN FRANCE.—According to advices from Paris, the French cabinet on February 16 approved the recommendations of the Committee of National Defense relative to the organization of wireless stations. The coast and interior stations for commercial purposes will include extra powerful plants at Ouessant, Marseilles, and Algiers, and ordinary stations at Boulogne, Havre, St. Nazaire, Nice and Cape Corso. They will be placed under the administration of the Ministry of Posts and Telegraphs. Extra powerful naval stations will be elected at Toulon, Bizerta, and Oran, and ordinary stations at Dunkirk, Cherbourg, Brest, Lorient, Rochefort, and Ajaccio. They will be under the administration of the Ministry of Marine. Finally, special military stations will be established, under the War Ministry, in the interior, on the frontiers, and in connection with the lighthouses. The installations of all the stations will be conducted under the Ministry of Public Works. In the event of war the military authorities will take over all the stations.

METER ACCURACY.—With regard to a complaint in one of the newspapers from an anonymous correspondent, attacking the meters of the New York Edison Company as to their "unreliability" so that the company "simply charge" what they think is right, Mr. J. H. Hallberg hits this nasty calumny pretty hard in a reply and says: "I have personally managed one of the largest electric lighting corporations in this country, which gives me authority to state that the meter department of any public service corporation is the most important, and is generally in the hands of highly educated technical men of wide experience, who would not dare to adjust a meter to register fast or slow. The friction in an electric meter, as well as any other machine, increases with wear and dirt; therefore, it is safe to say that a meter once set to operate properly would rather run too slow than fast with time. It is simply ridiculous to assume that any public service corporation guesses at the amount of current used by its consumers. The age of the unreliable electric meter is long past, and, barring accidents and abnormal conditions, all electric meters are correct within one-half of 1 per cent."

HONORS FOR GUESTS.—The board of trustees of the Western University of Pennsylvania has recommended that honorary degrees be awarded to the following twenty-nine distinguished foreigners, who are to be present at the founder's day exercises of Carnegie Institute in April next: Doctor of Laws—Baron Descamps, Baron d'Estournelles de Constant, Dr. Reinhold Koster, Ernst E. von Ihne, Lieut.-Gen. Alfred F. J. L. von Loewenfeld, Theodore von Moeller, Sir Robert Ball, Sir Robert Cranston, Guglielmo Marconi, Dr. P. Chalmers Mitchell, Dr. John Rhys, Dr. S. Roberts, J. Th. Homolle, Prof. Fritz Schaper, the Earl of Southesk, Sir William Turner, Edwin A. Abbey, Sir William Henry Preece. Doctor of Literature—Leonce Benedite, C. F. Moberly Bell, Hammond Hall, Clement K. Shorter, W. T. Stead, Joost Willem Van der Poorten Schwartz. Musical Doctor—Sir Edward Elgar. The degrees will be conferred at ten o'clock on the morning of April 13. Some of these visitors from Europe will participate in the dedication exercises of the Engineering Societies Building, in New York, the following week.

UNPOPULARITY OF MACHINERY.—Discussing an article in the *Nineteenth Century*, by Mr. R. N. Weekes, on the "Curse of Machinery," the point is contested by the New York *Evening Post* that machinery is either a curse or unpopular, as the writer would argue. It says incidentally: "As for brand-new machines, their reception suggests nothing so much as those old prints showing the cheering crowds welcoming the first railroad trains and the first steamboats. The machine for wide transmission of music got its first bill through the Legislature the other day, we believe, as easily as the first Western railroads got their charters. The phonographs and their ilk have just been confirmed by Congress in their right to reproduce musical compositions without paying royalty unless for public performance. The airship has only friends. Arguments that these are 'curses' cannot prevail for a moment against them. That these devices will, in turn, go the sad way of the railroad is only too probable, however. Airships will be pot-shotted by envious persons on the ground level. The fact that balloons have been in the past is an exception that only helps our argument. And some twenty-first-century attorney-general may yet be prosecuting the 'music-on-tap' companies for a conspiracy in restraint of trade cutting off the output of all music but the contemporary equivalent of rag-time."

SIGNS AND TROLLEYS.—A very pertinent suggestion as to the use of electric light signs for trolley systems is made by the *Street Railway Journal* as follows: "Considering the profits which are being reaped in so many lines of business by the judicious use of electric signs, it is a bit odd that street railway companies have not as yet generally realized what might be done with the electric sign in the way of traffic stimulation. The matter is certainly worth a few moments' thought, as the plans for the coming open season are being carried into effect. Electric signs have, of course, been used extensively to indicate routes on cars and to direct passengers at station platforms, but little has been done as yet to make the fixed electric sign on the busy street effective in advertising the attractions of various pleasure rides on the local trolley cars. The so-called talking sign has been brought to a high state of efficiency within the last year or two, and the cost of operating even a pretty elaborate affair with two or three hundred, perhaps more, 8-cp incandescents upon it, is a small matter if the street railway company supplies the current. Illuminated electric signs giving the time each minute and pointing out the appropriateness of celebrating the passing hours with a certain highball are frequently seen in our large cities. Fixed signs can be made up in a company's own shops at small expense, they cost practically nothing to operate, and there ought to be a profitable field for their use in the coming spring and summer. They will usually be found a cheaper method of advertising than by circulars; in addition, they attract the attention of the man in the street at a time when a car is close at hand and can be taken easily."

THREE-PHASE TRACTION was the title of an address given by Mr. Gerard B. Werner before the Electrical Engineering Society, at Columbia University, on Tuesday evening of this week. The meeting was well attended.

TELEPHONIC INTERCHANGE.—A bill has been introduced in the Tennessee Legislature to compel an interchange service between telephone companies doing business in the state, with a small rate of exchange for calls from one system to another.

WINNIPEG TELEPHONES.—In spite of the hot agitation carried on for municipal telephones in Canada, the City Council of Winnipeg, Manitoba, has petitioned the provincial government not to enforce its municipal telephone franchise until 1908 because of the bad financial condition of the city.

A. I. E. E. IN BOSTON.—A meeting of the Boston branch of the American Institute of Electrical Engineers was held on Wednesday evening, Feb. 20, at 8 o'clock, in room 6, Lowell Building, Massachusetts Institute of Technology. A paper on "Some Features of Power Plant Operation" was given by Farley Osgood, general manager of the New Milford Power Plant, New Milford, Conn. The paper was illustrated.

THE TROLLEY AND THE TELEPHONE.—According to an Indiana correspondent the telephone lines south of Fort Wayne, Ind., have been put out of service by the single-phase trolley of the Fort Wayne & Springfield Railway. The telephone company will have to rebuild its line to Decatur and change the rural lines to the local battery system. This means a large expense and, it is said, litigation may ensue to determine whether or not the traction company is liable for such expense and for damages.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION.—The first quarterly meeting for this year of the Fifth District of the Indiana Independent Telephone Association was held at Columbus, Ind., Feb. 7. Encouraging reports were made from the nine counties in the district. Mr. C. S. Norton, of Indianapolis, read a paper on "Financing Telephone Property," which was well received. The following named officers were elected: W. H. McPherson, of Brownstown, president, and W. B. Reed, of Seymour, secretary.

FREIGHT TROLLEYS.—In an address before the New England Rubber Club, Mr. Byrnes, vice-president of the New Haven, explained that the company had been getting control of trolley lines in its territory, because the management believes the time is coming when these electric roads will distribute and collect freight and express matter between the railroad stations and the store doors of the merchants. That will mean the delivery of goods without the use of carts and wagons and drays, without extra charge to the railroad's customers.

TELEPHONY IN STRAITS SETTLEMENTS.—U. S. Consul-General D. F. Wilber reports that only one company is engaged in furnishing Singapore with telephones, and it has about 1,500. In Penang and in the Federated Malay States the Government operates the systems. The instrument used is the "magneto," made in Antwerp, Belgium. Of these Penang has 500 and the Federated Malay States 300. Singapore buys about 250 telephones annually, Penang 75 and the Federated Malay States 50. Thus far the service in Singapore has been very unsatisfactory. Quite a large sum of money is being expended in improvements, placing wires under ground, etc.

STREET RAILWAY COMMITTEE ON MUNICIPAL OWNERSHIP.—The American Street and Interurban Railway Association has appointed the following Committee on Municipal Ownership: Mr. C. D. Wyman, chairman, general manager Stone & Webster, Boston, Mass.; Mr. John A. Bealer, general manager Denver City Tramway Co., Denver, Col.; Mr. George F. Chapman, general manager United Railroads of San Francisco, San Francisco, Cal.; Mr. H. M. Sloan, general manager Calumet Electric Street Railway Company, Chicago, Ill.; Mr. J. J. Stanley, general manager Cleveland Electric Railway Company, Cleveland, Ohio.

HEAVY DEPRECIATION.—A special dispatch from London of February 15 says: "The shareholders of a number of the London joint stock banks have learned something about municipal trading in the last two or three weeks. They have learned that through reckless borrowings municipalities which go in for trading heavily have caused enormous depreciation in their securities. The managers of several of the banks at the recent meetings took large amounts out of the net profits in order to write down the book values of depreciated municipal securities. The London and County Bank treated in this way £50,000 which it had earned during the year, the National Provincial did the same thing, and other banks pocketed losses nearly as large. The people of this country are beginning to understand that municipal socialism is expensive."

COAL MINING.—It is reported by the newspapers that electrical engineers are investigating the possibility of operating the Delaware & Hudson's Pennsylvania properties by electric power. These properties consist of about thirty different mining operations, including both breakers and washeries, and thirty-seven miles of railway from Carbondale to Wilkesbarre. The road is all double-tracked and for considerable distances there are three and four tracks. Up to this time it has been considered very doubtful whether operation by electricity under such circumstances could be successfully carried out, but engineers are now reaching the conclusion that it would be practicable. The cost of the many detached plants has increased since firemen and engineers had their working day reduced to eight hours. Electrical operation is expected to largely offset this extra expenditure.

A BRITISH CENSUS.—U. S. Consul Rufus Fleming, of Edinburgh, reports concerning the passage, in December, of a bill by the British Parliament to secure reliable statistical returns of the country's industrial products, somewhat similar to the manner in which the United States Census Bureau has long pursued. The law is called a "Census of Production Act." Under its provisions a return must be made in 1908, and subsequently, at such intervals as may be determined by the board of trade, of the output, the number of days worked, the number of persons employed, the power used or generated, etc., in all trades where production is carried on, including business where work is given out to be executed elsewhere than on the premises of the person or firm making the return. The law applies to all factories and workshops, mines and quarries, buildings and alterations on buildings, all works of construction such as railroads, canals, tramroads, harbors, docks, sewers, roads, reservoirs, laying of water or gas pipes, telegraph and telephone lines, etc. It does not ask for a return of wages paid or of capital invested in the industries, but is restricted to production and employment. It would seem that municipalities are placed on the same footing as other employers by a clause which provides that "the exercise and performance by a local or other public authority of the powers and duties of that authority shall be treated as the trade or business of that authority." Thus, returns must be made of public gas works, water-works, electric-light plants, tramways, and other municipal operations. In short, Parliament has given to the Board of Trade the means of fully ascertaining the volume of production and of business and the conditions of occupation in every department of industry, excepting agriculture, fishing and forestry, which this act does not cover.

A SPOKANE SUBWAY.—A subway franchise for the Inland Empire Traction Company has been reported favorably by the city council. It is perpetual and provides for no compensation to the city. The company has the privilege of selling and can make the tunnel as narrow as it desires and fix its own terms for rental. It is given the permission to open two city blocks at a time. The right is given to use either steam or electric power. The company has five years within which to complete the work.

LIGHTING AT CONSTANTINOPLE.—There has long been a grave prejudice on the part of the Turkish authorities against electric light and power, but now the Turkish papers of Constantinople on January 20 announced that an irade was issued in October last authorizing the ordnance department to make arrangements for the electric lighting of the city and suburbs and the European shores of the Bosphorus. A dispatch from Constantinople says that it is hoped that the Government will invite tenders from all countries for this important concession, which should afford American firms an opportunity of competing.

AUTOBUS AND SUBWAY.—A special dispatch from London of February 9 says: "After all the abuse that was heaped on the noisy, evil-smelling, nerve-destroying autobus a few months ago it is now interesting to note the effect the autobus has had on the underground tube railways and what it means to London. The 'Twopenny tube,' which only the other day was regarded as almost the last word in locomotion, has lost 1,000,000 passengers during the year and the responsibility is laid on the autobus. It is not an isolated instance, for the same story has been told at almost every railway meeting here during the last few weeks. It is wonderfully eloquent of the hold which the huge, unwieldly but fast-moving vehicle has gained here and the agitation which only a few months ago was raised against the motor seems ludicrous in the face of such figures as those mentioned at the meeting of the 'Tube Inc.' the other day." One is reminded of the bicycle scare that trolley managers had a few years ago at the height of the craze.

TELEGRAPHERS' WAGES.—The Western Union Telegraph Company has announced a 10 per cent increase in wages, in the following official letter: "This company has received petitions within the last 60 days from sixteen offices in the West and Southwest asking for an increase of 10 per cent in the salaries of employes. In this connection it has been necessary to consider the enormously increased cost of all kinds of telegraph material, which in many cases has been from 50 to 100 per cent, while the tariff rates on messages and other traffic are very low in view of the demands of the public for ever-increasing facilities and more rapid service. In fact, many of these rates are relics of former ruinous competition, and are unprofitable. Notwithstanding these facts the company has decided to increase the salaries of operators at its principal offices 10 per cent from March 1, 1907." Vice-President William H. Baker, of the Postal Telegraph Company, has issued a statement saying that the company would do as well, if not better, by its employes than any other company. The company, he said, received requests from about five or six of its offices for readjustment of the wage scale, and had complied with the request in all but one or two instances, which were now under consideration.

MALLOCK ON MUNICIPALISM.—Mr. W. H. Mallock, who is giving a series of lectures at Columbia University under the auspices of the National Civic Federation, discussed the relation of municipal ownership to socialism last week and said: "I am not going into municipal trading, as it is called in England, from the standpoint of the accountant. That is hardly necessary, for it is a well-known fact that municipal trading has a tendency toward the wrong side of the ledger. The London County Council has in mind the vast project of taking over all the electrical business in the city, but what member of the London County Council has become famous through his knowledge of the electrical industry? What member has helped to advance that business a single step? Some of the boroughs have already taken over a number of electrical undertakings with the distressing result that while they are almost universally losing money the consumers are forced to pay higher rates than in the boroughs where the lighting is done by private companies. The members of the County Council who were elected on a Socialistic platform have been twitted by their constituents because they have gone more and more into capitalistic enterprises, and in spite of their principles as Socialists have in effect tried to become the greatest capitalists in the City of London."

AUTOMOBILE MANUFACTURE.—The U. S. Census Office has just issued an interesting bulletin of the figures collected in 1905 as to the bicycle and automobile industries. In five years the output of bicycles fell off from $31,915,908 to $5,153,240. Meantime the automobile industry grew at a very rapid rate, and the product increased in value from $4,748,011 in 1900 to $26,645,064 for the year 1904. In 1900 the number of automobiles turned out by regular manufacturers was 3,723. At the census of 1905, the total output was 22,830. Of the 21,692 machines turned out by automobile factories, 18,699, or 86.2 per cent, were propelled by gasoline; 1,568, or 7.2 per cent, by steam, and 1,425, or 6.6 per cent, by electricity. Michigan turned out the largest number of machines; while Ohio stood second in this respect; Wisconsin, third; Massachusetts, fourth, and New York, fifth. These 5 states reported 85.3 per cent of the total number of machines manufactured in the entire United States. Of the total number of automobiles manufactured in automobile factories, 12,131, or 55.9 per cent, were runabouts, and 7,220, or 33.3 per cent, touring cars. Buckboards stood third in number turned out, 675; stanhopes fourth, with 520, and delivery wagons fifth, with 411. Michigan reported more than one-half the total number of runabouts, and more than one-third the total number of touring cars. Ohio also turned out more than one-third the total number of touring cars. The capital invested in the automobile industry at the end of 1904 was $20,555,247, since when it has probably doubled.

METAL-WORKING MACHINERY is to-day very largely driven by electric motors, a fact that gives additional interest to Bulletin 67, just published by the Bureau of the Census, presenting statistics relating to the manufacture of metal-working machinery in the United States in 1905. This bulletin was prepared under the supervision of Mr. William M. Steuart, chief statistician for manufacturers, by Mr. Fred J. Miller, expert special agent. The term "metal-working machinery" is defined as relating only to power-operated machines for working metals, including also the parts and small tools necessary for the operation of the same, but does not embrace machines or tools for use in the hand trades. The total value of metal-working machinery manufactured in 1905 was $32,408,766. Despite the fact that this industry had only partially recovered from the general industrial depression in 1903, the census shows an increase of $7,670,862, or 31 per cent, in the value of metal-working machinery manufactured in 1905 as compared with 1900. An increase varying from 8.4 per cent for New Jersey to 87.3 per cent for New York is shown for all the leading States except Pennsylvania, for which a decrease of 9.6 per cent was reported. The greatest absolute increase in value of products is shown for Massachusetts. The depression which ensued in 1903, especially in the iron and steel industry, affected the foreign trade in metal-working machinery to a very marked extent. The exports decreased from $7,193,390 in 1900 to $2,826,111 in 1903, while the imports increased slightly. At the time of the census, however, the industry was beginning to recover from the depression and a large increase in exports was noted.

Applications of Electricity in the Mess Hall at West Point, N. Y.

EVERY one visiting the United States Military Academy at West Point is naturally interested in the cadet mess; for good soldiers must needs have wholesome food, and wholesome food presupposes that it is properly prepared. Needless to state the mess hall is scrupulously clean, and is provided with all the necessary accoutrement for the proper preparation and rapid serving of the food. There are at present about 470 cadets at the Military Academy and the mess hall has accommodations for 700. The cadets breakfast at 6.30, dine at 12.15 and sup at 6 o'clock, and since all eat at once, everything must

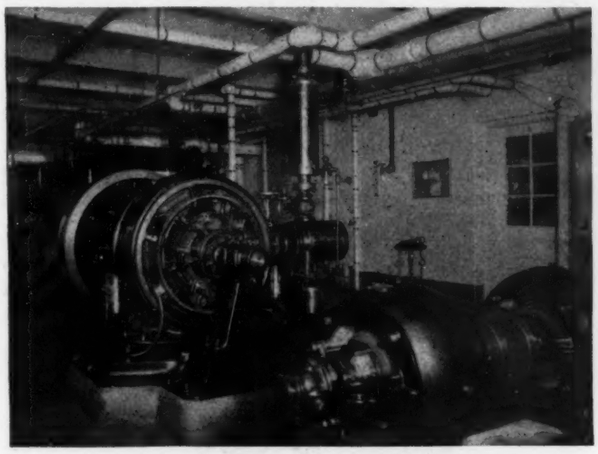


FIG. 1.—POWER PLANT IN THE MESS HALL.

move with military precision. The working force consequently is capable of handling a maximum load.

West Point is visited by thousands annually, who although feeling a pride in the historic military post and academy also expect that the institution shall be conducted in as efficient and economical a manner as possible. Manual labor in the mess hall is, therefore, reduced to a minimum and advantage taken

FIG. 2.—VIEW OF THE SOUTH SCULLERY.

of all kinds of mechanical devices. These for the most part require electricity for their operation so that the applications of electricity are many and varied.

All the doors leading into the dining-room from the kitchen and serving rooms open and close automatically, so that there is no slamming of doors or breaking of dishes by this means. In order to pass through the doorway it is necessary to step on a platform which is so connected to the door that the weight of the body causes the door to swing open. The waiters with their trays enter by one door and leave by another.

The kitchen, a view of which is given herewith, is presided over by two cooks—a chef and an assistant. This is all the skilled labor necessary, the others merely carrying out their instructions. In the preparation of the meals electricity plays an important part; but the actual cooking is done with steam and with anthracite and charcoal fires. In the bakery is an electrically-operated flour-handling outfit and bread mixer which is simple, clean and economical. The flour is emptied from bags into an elevator where it is sifted and carried to the flour storage bin to be used as desired. From the bin the flour is carried by conveyor screws to automatic flour scales where it is

FIG. 3.—CORNER OF BAKERY.

accurately weighed and deposited into the dough kneader. Water and yeast scales are also automatic in their action and weigh accurately the required amount of water and leavening material for the quantity of flour used. The outfit is driven by a 5-hp motor.

After the dough has been well kneaded, the agitators are thrown out of action and a screw forces the dough out of the

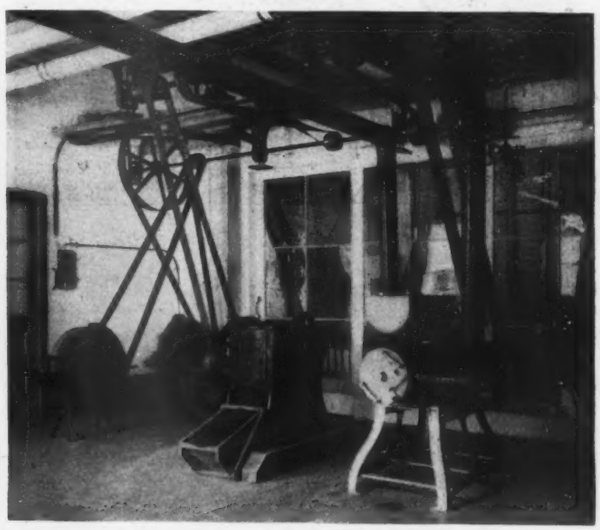


FIG. 4.—MILK PASTEURIZER AND MOTOR-DRIVEN ICE CREAM FREEZER.

mixer into a wooden trough. This is wheeled to a dough divider, driven by a 1½-hp motor, where it is separated into pieces of the size required for each loaf. After passing through this machine the dough is thrown into a moulding machine passing directly thence into the forms in which it is baked. The outfit is shown in Fig. 3 and is arranged so that the various operations follow each other in sequence. In this way the bread practically passes from the flour bag to the oven without being

handled. After leaving the oven the bread is placed in cooling racks as shown in Fig. 5. Rolls are cut to proper size by a separate machine. One hundred and fifteen loaves of bread are baked daily and nearly one thousand rolls.

Fig. 5 shows the soft dough mixer which is driven by a ¾-hp motor. In this machine the dough for the cakes and pies is prepared. The agitator is arranged for two speeds and can be changed from 25 r.p.m. to 100 r.p.m. without stopping the machine. The former speed is used in kneading the soft dough for cakes and the latter speed is used for beating eggs, the machine in this respect serving a double purpose.

A very interesting labor-saving machine is the potato peeler, which may also be used for peeling hard fruits such as apples and pears. This machine is driven by a belt from a ½-hp motor bolted to the wall. A bushel of potatoes is dumped into the machine, the bottom of which revolves. The inner cylinder, which is stationary, is provided with a grating surface, and as the bottom revolves the potatoes are thrown against this surface by centrifugal force and are in this way deprived of their skin. Water is permitted to flow into the machine while it is in operation and the peeling is carried away in the form of pulp to the sewer. A small door in the side allows the potatoes to fall into a basket or other receptacle when the peeling operation is finished. It is only a matter of a few minutes from the time the potatoes are dumped into the machine until they are peeled, and when it is considered that about four barrels of potatoes are used daily the economy of the apparatus is apparent. The machine does not, of course, remove the eyes from the potatoes, and if necessary these may be removed afterwards; but it saves time and material as well.

In Fig. 4 a number of machines are shown group-driven by

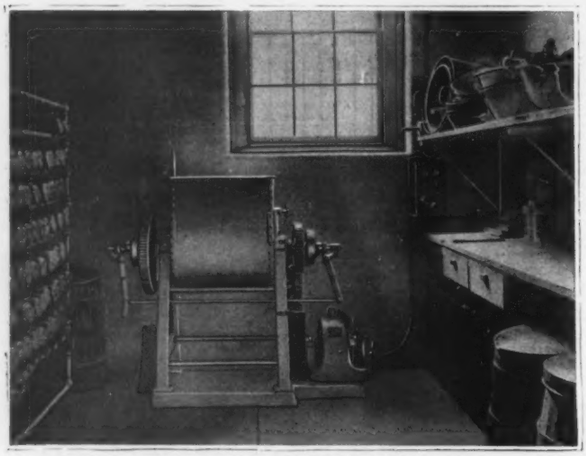


FIG. 5.—SOFT DOUGH MIXER AND EGG BEATER.

a 5-hp motor. The former consist of a grindstone, ice breaker and ice cream machine, while back of these and shut off by a glass partition is a milk sterilizer. One hundred and eighty gallons of pure milk is sterilized in this machine every morning. The milk is brought from a dairy farm in Cold Spring, where every precaution known to science is exercised—the cows, stalls, etc., are regularly inspected, the milk tested, the cans sterilized and other refinements practiced, so that a pure and wholesome dairy product results. To guard against any possible contamination the milk and cans are again sterilized or rather pasteurized at the mess hall before it is served to the cadets. The milk passes through three receptacles during the process. In the first it is heated to 180° F.; it is immediately passed to the next receptacle where it is cooled and from this to the third receptacle arranged as a refrigerator where it is further cooled to about 38° F. The milk is constrained to pass through each receptacle in sort of a thin spiral, so that every particle of the milk is brought into intimate contact with the heating and cooling coils so that the bacteria are effectually destroyed. The pasteurizing machine is driven by an electric motor.

The ice cream freezer is surrounded with refrigerating coils, but otherwise does not differ from the ordinary household freezer save that it is horizontal instead of vertical and is driven through belt from the motor. There is a peep-hole provided in the cover of the freezer which is wiped by a piece of wood as the dasher revolves. When the cream is frozen the glass is covered with frost upon which the wooden wiper has no effect. The attendant then opens a door and the cream is pushed out by a screw.

All the cutlery and silverware is polished on a Northern buffer motor and the knives are sharpened on a motor-driven cutlery renovator. Both these machines are attached to a table

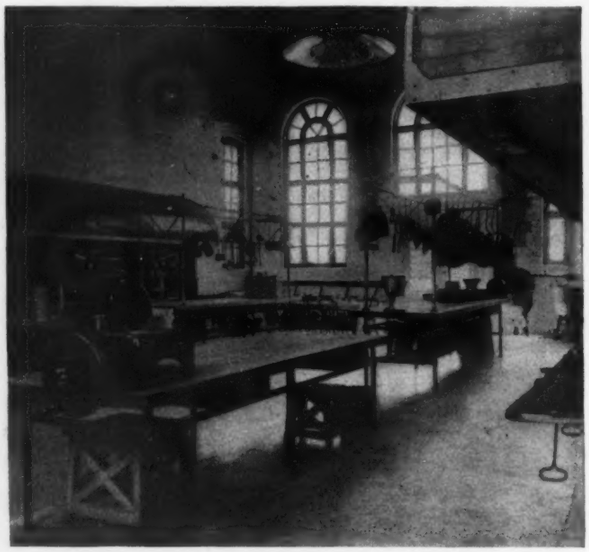


FIG. 6.—KITCHEN, MESS HALL, WEST POINT.

in the same room with the potato peeler. Fig. 2 is a view of the south scullery. Here the dishes are washed in a washing machine driven by a 5-hp motor, the dishes being first placed in wire baskets. They are then removed and placed in another trough where they are rinsed in scalding water after which they are placed on the tables shown to dry.

The power plant is shown in Fig. 1. It consists of a 37½-kw Westinghouse 125-volt generator direct-connected to a Harrisburg engine, the exhaust from which is utilized in heating water. There is also a Northern motor-generator set consisting of a 500-volt motor and a 115-volt generator having a capacity of 18½ kw. The 500-volt current is received from a plant on the river front. There is in addition an ice-making plant working on the absorption system. Although natural ice is abundant in the Hudson River, the cost of cutting and storing this and the labor required in rehandling it is such that considering the cleanliness, reliability and convenience of the refrigerator system especially in those rooms set aside for the storage of meat, fowl, dairy products and fruit, and also in the pasteurizing machine and ice cream freezer, it is not to be compared with the latter system. The coal is brought from the river in carts or sleds, depending on the season, and dumped in a storage bin adjoining the boiler room. The bin is provided with manholes through which the coal is dumped from the carts overhead, and these are so situated that no trimming whatever is required.

The plant is a model one for its size and everything connected with it is kept in first-class condition. Nothing is permitted to go to waste in the kitchen. The beef fats are used in cooking, especially in frying potatoes, being more digestible and palatable than the fats usually used for this purpose, and the grease from all sources is sold or utilized for making soap. When the appropriation can be secured an incinerator will be installed for the disposal of the garbage. The cadet mess is in charge of Captain Thomas Franklin, to whom we are indebted for many courtesies extended in the preparation of this article.

Resistivity-Temperature Formulæ for Copper.

BY DR. F. B. CROCKER.

THE variation in resistivity of copper with temperature change has been much investigated and written about. Nevertheless there is still considerable confusion in regard to it. This is due to differences in chemical and physical character of the copper used as well as to the manner in which the results have been formulated.

The original formula of Matthiessen[1] was as follows:

$$C_t = C_0 (1 - .0038901t + .000009009\, t^2) \qquad (1)$$

in which C_t is the conductivity of copper at any temperature, t in centigrade degrees and C_0 the conductivity at 0° C. Right at the start this formula inflicts three serious difficulties upon us. First, there are too many decimal places, this physical relation being inherently incapable of such precise statement, in fact it is absurd on its face. Assuming $t = 100°$ C., which is higher than the allowable working point of apparatus or circuits, it is evident that an increase of only about 1/400 of 1° in the value of t would have the same effect as the omission of the last two figures of its coefficient! Furthermore, it is a fact that very slight differences in chemical composition or physical treatment would alter the last three if not four figures of the coefficient of t. As we shall see later, the A. I. E. E. Standardization Rules followed in this country adopt a value for this coefficient which is 5 *per cent greater* than that accepted in Germany. Hence the use of *five* significant figures is preposterous when the *second* is very doubtful.

The second objection to Matthiessen's formula is the presence of the term containing t^2. This is not only a complication, but is also at variance with the physical fact. More recent investigations with modern samples of copper show a rectilinear increase of resistivity with temperature rise[2]. In other words, the coefficient of t^2 is zero, or negligible. It should be noted, however, that the omission of this term requires the coefficient of t to be raised to .004 or .0042 as shown later.

The third difficulty with Equa. (1) is the fact that it refers to conductivity according to the point of view at Matthiessen's time, whereas we now follow the conventional form of Ohm's law and make our calculations in terms of resistance. If we attempt to convert Equa. (1) into a formula for resistivity by taking reciprocals we obtain the following:

$$R_t = R_0 (1 + .00387t + .000005968t^2 - .0000000011173t^3 + .000000000000083t^4 - \text{etc.}) \qquad (2)$$

This is an infinite series that is not so rapidly convergent as it appears to be, and the mistake has been made of disregarding all terms containing powers of t higher than t^2, assuming them to be insignificant, in which case we have:

$$R_t = R_0 (1 + .00387t + .000005968t^2) \qquad (3)$$

The fact that this formula is given in many books and generally accepted as substantially correct, is really a great joke on the electrical profession. As a matter of fact, the higher terms are not negligible for any considerable values of t. For example, if $t = 100°$ C. this equation gives results 1.72 per cent higher than those obtained from the original Matthiessen formula (Equa. 1). This, however, is only part of the joke because I find that the error is reduced to .33 per cent, which is less than one-fifth as great, by changing the coefficient of t^2 in Equa. (3) from .000005968 to .000004 at the same time gaining very much in simplicity. It is certainly ridiculous that authors have persisted in writing this coefficient with nine decimal places and four significant (?) figures, when three of the former were unnecessary and all of the latter were wrong! In fact, we may go even farther and alter both coefficients to get still closer approximations. For example:

$$R_t = R_0 (1 + .004t + .0000024t^2) \qquad (4)$$

This equation gives results at 100° C, which are only .1 per cent above those derived from the original Matthiessen formula, while we have seen that the figures obtained from Equa. (3) are 1.72 per cent too high. Of course, it is mathematically impossible to get in this form the exact equivalent of Mattheissen's formula, the only absolutely correct method being to determine by Equa. (1) the conductivity at any given temperature and take the reciprocal of that value in order to find the corresponding resistivity. In this manner the "Copper Wire Table" (Matthiessen's Standard) of the American Institute of Electrical Engineers[3] was calculated. The objections to this method, as already explained, are the undue complication of Matthiessen's formula in decimal places and number of terms, the necessity for passing to reciprocals, and the nonconformity with the physical facts.

These difficulties are, to a great extent, overcome by using the equation adopted in the A. I. E. E. Standardization Rules as follows:

$$R_t = R_0 (1 + .0042t) \qquad (5)$$

Even this amended formula is, however, open to some question. As already stated, very slight differences in the purity or treatment of copper will affect its temperature coefficient, so that the particular value adopted is, at best, only an average one, from which individual samples may exhibit considerable departure.

The German Rules[4] adopt .004 instead of .0042 as the temperature coefficient. On the other hand the British Engineering Standards Committee[5] use in certain calculations a coefficient of .00428. Determinations of temperature rise in the coils of electrical apparatus are often based upon this coefficient,, hence its assumed value should not be too high because it would indicate temperatures less than the actual. In other words, it is safer to adopt the lower figure. Conversely, calculations of increased resistance with temperature rise would in the latter case give results too low. All things considered, therefore, the coefficient .0042 adopted by the A. I. E. E. appears to be about right. There remains, however, the difficulty that this coefficient refers to resistivity at 0° C., as shown in Equa. (5). Hence, at an initial temperature of, say, 20° C,, it is necessary to calculate by means of this equation, what the resistivity would be at 0° C., and from that determine what it would become at some other temperature, say 70° C., using the same equation. This is not a serious matter, but is somewhat awkward, and may be avoided as suggested by Dr. A. E. Kennelly[6], by using a temperature coefficient corresponding to the initial temperature, the formula being:

$$R_{t+\theta} = R_t (1 + a\theta) \qquad (7)$$

in which R_t is the initial temperature, $R_t + \theta$ the final temperature after a rise of θ degrees, and a is a coefficient varying with the initial temperature t as follows:

$t =$	$a =$
0° C.	.0042
12°	.0040
25°	.0038
40°	.0036

COMPARISON OF RESULTS.

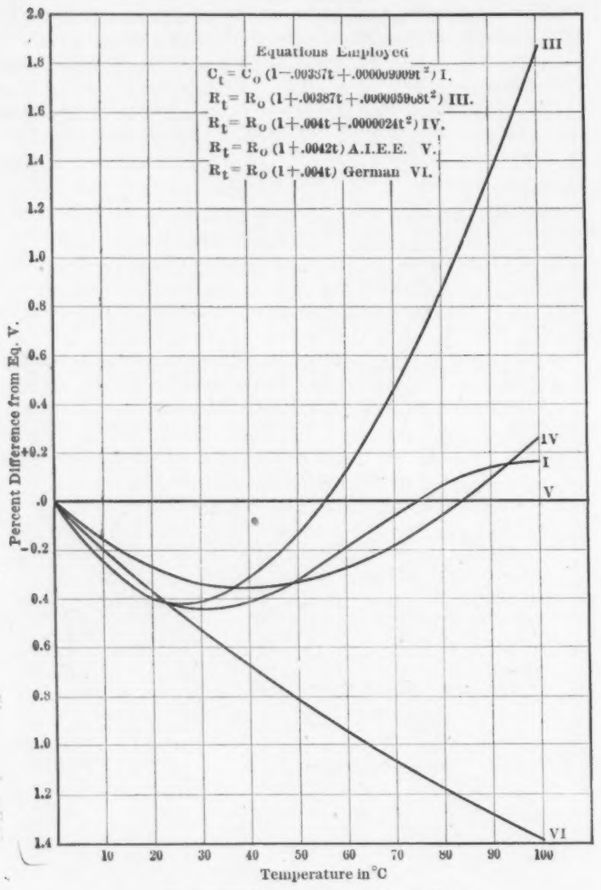
Temp. °C.	Resistivity by Equation V.	Resistivity by Equation I.	Difference in % from V.	Resistivity by Equation III.	Difference in % from V.	Resistivity by Equation IV.	Difference in % from V.	Resistivity by Equation VI.	Difference in % from V.
0	1	1	0	1	0	1	0	1	0
10	1.042	1.03929	—.26	1.03930	— .26	1.0402	—.17	1.04	— .19
20	1.084	1.07968	—.40	1.07979	— .39	1.08096	—.28	1.08	— .37
30	1.126	1.12107	—.44	1.12147	— .4	1.12216	—.34	1.12	— .53
40	1.168	1.16332	—.41	1.16435	— .31	1.16384	—.35	1.16	— .68
50	1.210	1.20625	—.31	1.20842	— .13	1.2060	—.33	1.20	— .82
60	1.252	1.24965	—.18	1.25369	+ .13	1.24864	—.27	1.24	— .95
70	1.294	1.29327	—.06	1.30015	+ .47	1.29176	—.17	1.28	—1.08
80	1.336	1.33681	+.06	1.34781	+ .88	1.33536	—.05	1.32	—1.20
90	1.378	1.37995	+.14	1.39666	+1.35	1.37944	+.10	1.36	—1.30
100	1.420	1.42231	+.16	1.4467	+1.88	1.424	+.28	1.40	—1.42

[1] Philosophical Transactions, 1862.
[2] ELECTRICAL WORLD, February 19, 1895, P. 196.
[3] Transactions, October, 1893.
[4] Recommended by the Verband Deutscher Elektrotechniker.
[5] Report No. 19, "Temperature Experiments on Field Coils," pages 14 and 16.
[6] ELECTRICAL WORLD, June 30, 1906.

The values of the coefficient for each degree between 0° and 50° C. are given by Dr. Kennelly.

The table herewith (page 385) contains the coefficients or ratios of resistivity obtained from the several formulæ for different temperatures.

The accompanying curves show a comparison of these results. They are plotted with reference to the A. I. E. E. formula (Equa. 5), that is, the latter is represented by the horizontal or zero line, and assumed to be accurate at all temperatures. The vertical distance between any curve and this horizontal line represents the percentage of difference in results obtaind by the corrsponding formula and that of the A. I. E. E., for temperatures between 0 and 100° C. Similarly the vertical distances between two curves show the difference in results given by the corresponding formulæ at the various temperatures. For example: Equa. (3) differs from Equa. (5) by 1.88 + 1.42 = 3.30 per cent at 100° C., which is a large amount.



RESISTIVITY TEMPERATURE CURVES.

CONCLUSIONS.

1. The original Matthiessen's formula (Equa. 1) is not easily applied and does not conform exactly to the facts, but owing to its historical prominence and continued use, it cannot be ignored.

2. The resistivity form (Equa. 3) of Matthiessen's formula often given, is entirely wrong mathematically and physically.

3. It is possible, however, to obtain such a formula for resistivity (Equa. 4) which agrees within .1 per cent with that of Matthiessen's as shown by the curves and table.

4. The formula (Equa. 5), adopted in the A. I. E. E. Standardization Rules is probably as nearly correct as any general expression can be made.

5. By using a varying temperature coefficient (Equa. 7), for example, .0038 with an initial temperature of 25° C., the ratio of resistance increase is obtained by simply multiplying this coefficient by the temperature rise.

The term resistivity has been used throughout, because strictly speaking it is this specific resistance that varies with temperature. It is evident, however, that the resistance of a given copper conductor will vary in the same ratio if its form and dimensions do not change. Expansion by heat is assumed to be so slight that it may be neglected, the coefficient of linear expansion of copper being only .0000172 per C°., and is therefore only about one-sixth of 1 per cent for 100° C.

Self-Regulating Alternator with Auxiliary Field.

By A. Heyland.

THE innovation described below has for its object to counteract in a very simple manner the demagnetizing action of the armature magnetomotive force of the load current on the magnetic field of the machine, and on the fall of potential. With this object the excitation is regulated by a current which, by a peculiar arrangement, is directly produced or influenced by the effect of the magnetomotive force of the armature current. By adding this regulating current to the excitation of the machine, so as to act in an inverse direction to the load current, it is easy to counteract all the known effects of the armature reaction on the field and to maintain the potential of the machine constant, exactly as is done with direct-current machines.

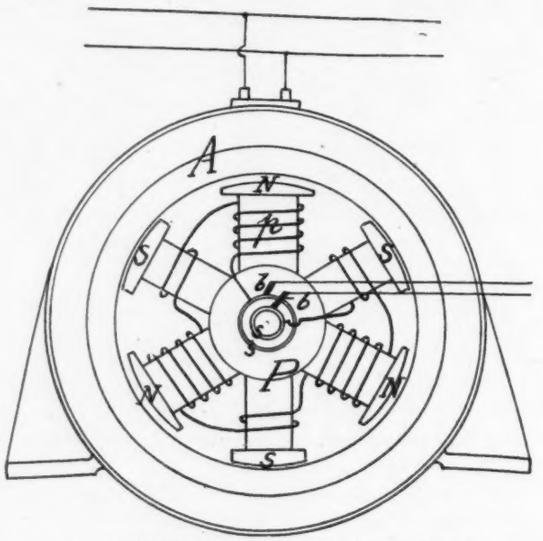


FIG. 1.—MEANS FOR PRODUCING STRAY FIELDS.

It is well known that in any electrical machine there exist stray fields in addition to the principal field in which the entire winding traverses and in which it generates the electromotive force. For all conditions of load the total field always equals the sum of the principal field and the dispersion field. The stray field, or rather each of the stray fields individually, depends partly on the construction of the machine. On the other hand, when the load varies, the magnitude of the stray field varies exactly in the same proportions as the magnetomotive force of the load current; that is to say, as the fall of potential at the terminals of the unregulated machine, or in other words in the same proportion as the field excitation, must be regulated (increased or diminished) in order to maintain the potential constant at the terminals.

The regulating current generated by such a stray field will, therefore, necessarily and instantaneously follow any variation of the load of the machine, and will be in proportion to the magnetomotive force of the load current. It is consequently extremely well adapted to compensate the effect produced by the reaction of the load current; that is to say, to regulate the field and maintain the potential constant.

It is very interesting to note here that in alternating-current machines, a regulation of this kind also takes into account the effect of the magnitude and the phase displacement of the load

current, exactly as in a compounded alternating-current machine, without its being necessary to have recourse to the load current itself, and to the use of special auxiliary apparatus, such as compounding transformers, commutators and the like, as are indispensable in all compounding systems. In fact any dispersion field combines the effects of the magnitude of the load current and its phase displacement, and the regulating

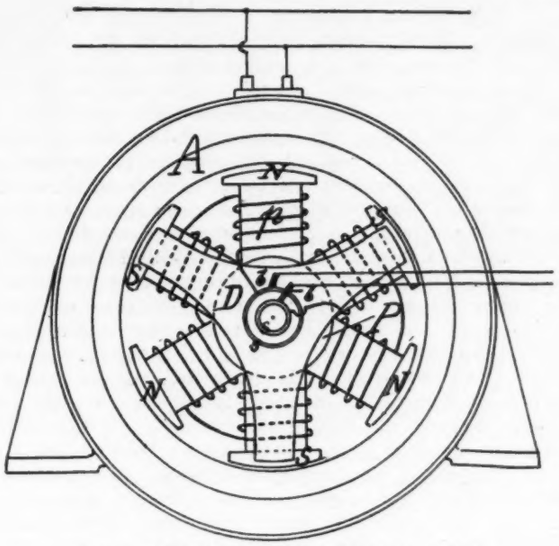


FIG. 2.—MEANS FOR PRODUCING STRAY FIELDS.

current, which varies in the same proportion as the said dispersion field, must thus at the same time correct the effect of the magnitude and the phase displacement of the load current. In case it is desired to obtain a different regulation for currents of different phase displacement, for instance, a stronger regulation for wattless currents than for watt currents, the machine may be provided with special arrangements which increase the dispersion for loads with wattless currents and the like. The degree of regulation may also be selected at will, so that the machine is exactly regulated, like a compounded machine, or even under-regulated, like an under-compounded machine, or over-regulated, like an over-compounded machine, or finally counter-regulated, like a differential machine.

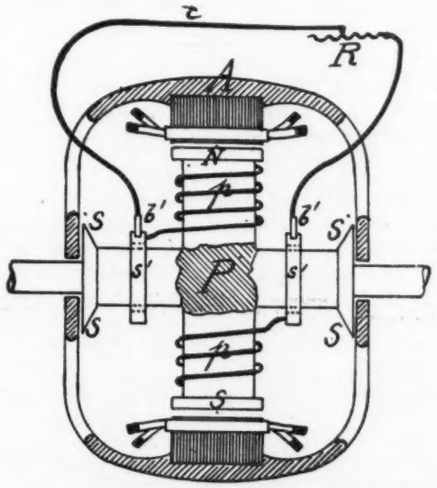


FIG. 3.—MEANS FOR USING STRAY FIELDS.

The regulating current may be generated either in the exciter, for example, by producing in the principal machine a stray field of such a form that it passes through the exciter, so that the active field of this latter increases or diminishes in proportion to the size of the stray field, or it may even be generated in a special circuit in which an e.m.f. is produced by a stray field of the principal machine. The regulation of the machine may be effected by taking the regulating current either to the field coils of the main machine, or to its exciter, or to a special winding provided on the poles of the principal machine or its exciter.

The method employed consists in producing in the machine an auxiliary stray field of peculiar form. This auxiliary field may be employed either in machines with an external source of excitation or in machines with a directly coupled exciter. In the former case the regulating current may be generated by a very simple arrangement in the principal machine itself; in the second case the regulating current may be generated directly in the exciter by the auxiliary field being superposed on the field thereof and directly acting to regulate this field, the action being independent of the numbers of poles of the two machines.

UNIPOLAR AUXILIARY FIELD.

With this object an auxiliary stray field of unipolar form is produced in the alternator, which field is similar to that in the so-called unipolar machines, and is closed through the shaft, the framework and the body of the machine. When the exciter is directly coupled to the principal machine, the stray field passes simultaneously through the armature of the exciter and is superposed on the field of the latter.

In normal machines having alternate poles of different polarity

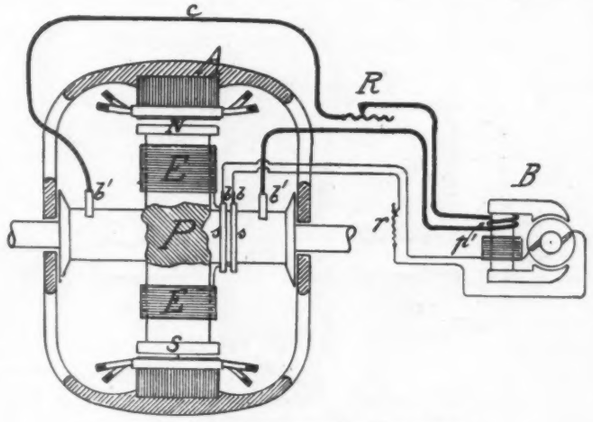


FIG. 4.—MEANS FOR USING STRAY FIELDS.

the auxiliary unipolar field is produced by simply providing in the pole structure a difference of form between poles of different polarity, the effect of which is that the magnetic reluctance and the armature reaction at the poles of different polarity become different. The result is that the intensities of the fields at the poles of different polarity become different, and especially that these fields vary in different degrees when a variation of load, and consequently a variation of the armature reaction is produced. The difference between these various poles of different polarity and intensity of field gives rise in the machine to a peculiar stray field, which assumes the unipolar form described above. The direction of this unipolar field is determined by the polarity of the poles having the preponderant intensity. Its magnitude is equal to the difference of the total intensities of the whole number of poles of the two polarities, and it increases and diminishes in exact proportion to the armature reaction of the load current.

Some typical examples will now be described to show the method by which the machines of normal form, a stray field of unipolar form may be produced.

In the accompanying drawings Figs. 1 and 2 show diagrammatically a six-pole alternating-current machine with a revolving field and fixed armature. *A* is the armature, *P* the pole wheel, *N* the north poles of the field, *S* the south poles, *p* the field coils, *s* two collecting rings, and *b* two brushes which are connected with the source of the exciting current.

In Fig. 1 the dissimilarity of the armature reaction of the

poles of opposite polarity is produced by having the number of turns of the field winding placed on the *N* poles greater than that of the winding exciting the *S* poles; moreover, the sections of the *N* poles are of larger dimensions than the sections of the *S* poles.

In Fig. 2 the dispersion of the lines of force of the *S* poles is greater than that of the *N* poles, which result may be obtained, for instance, by placing at the side a piece, *D*, of magnetic material in the form of a star (in the present instance in the form of a three-point star) which enables the dispersion flux of the *S* poles to close their magnetic circuit through the shaft of the machine.

In the cases illustrated the excitation and the intensity of the fields of the *N* poles will be greater than that of the *S* poles. Consequently the stray field will correspond to the direction of the *N* poles, and produce *S* poles at both extremities of the shaft, *S* (see Fig. 3). The magnetic circuit is completed through the shaft and the external part of the machine, as in a unipolar machine.

A stray field of this kind, so-called unipolar, may be employed in any type of normal machine for generating a corresponding regulating current, both for machines without separate excitation as well as for machines with a coupled exciter.

MACHINES WITH INDEPENDENT EXCITATION.

Fig. 3 shows an arrangement in which the regulating current

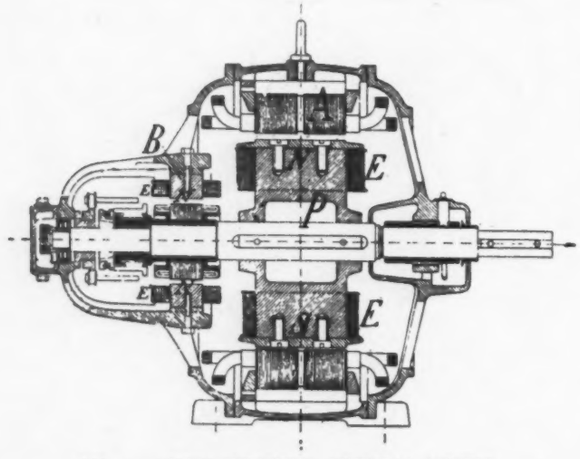


FIG. 5.—DIRECT-CONNECTED UNIPOLAR EXCITER.

is taken to the field coils of the principal machine, an arrangement which has in most cases less practical than theoretical interest, but which indicates the principal of the method. In Fig. 4, on the other hand, the regulating current is taken to the field coils of the exciter generator.

In Fig. 3 the field coils, *p*, which here also represent the regulating circuit, are connected with two slip rings, *s'*, and these latter are interconnected through brushes, *b'*, an external circuit, *c*, and a resistance, *R*.

The stray field of unipolar form must produce in this circuit a direct e.m.f. which varies in proportion to the intensity of the dispersion field. This e.m.f. being added to that of the exciting current in the field coils, must consequently regulate the excitation in proportion to the stray field and to the armature reaction of the load current.

The use of a unipolar stray field, with the object of obtaining a direct regulation, presents at first sight a somewhat serious difficulty arising from the fact that the electromotive forces generated by means of the unipolar field can in any case be only very weak. In spite of the fact that the power absorbed by the excitation represents only a small percentage of the power of the machine itself, there results therefrom very heavy exciting currents and the taking of the current at the brushes will certainly present difficulties.

The difficulty which the taking of current in the methods shown in Fig. 3 presents, is avoided if instead of directly regulating the field of the principal machine, the regulating current be employed for regulating the field of the exciter as shown, for instance, in Fig. 4. In this case the power of the regulating current need only represent a fraction of the excitation of the exciter, that is to say, an amount which is very small relative to the power of the machine.

MACHINE WITH DIRECTLY CONNECTED EXCITER.

The methods of construction with a unipolar stray field hereinbefore described employ special auxiliary circuits in which a direct regulating current is generated by unipolar induction, and relate to machines in which the exciter is not coupled to the principal machine. Fig. 5 shows a case where the exciter is directly coupled to the principal machine, the arrangement being still simpler when the stray field is employed for directly influencing the field of the exciter. In these machines a larger or smaller part of the stray field which depends on the construction of the machine, and which may also be regulated by a suitable arrangement must be superposed on the field of the exciter. It then suffices, as has been explained, to provide in this machine a dissimilarity corresponding to that of the principal machine in order that the field of the exciter may vary in the same proportion as the stray field, and the armature reaction of the principal machine. If the reaction of the load current increases the field of the exciter is reinforced, if it diminishes the field of the exciter will be diminished, and all the fluctuations of the armature reaction will be exactly compensated for in the excitation of the principal machine.

In Fig. 5 the exciter is mounted on the shaft of the principal machine, inside the frame. The principal machine has six poles, and the pole winding corresponds to that of Fig. 1 or 4. Any variation of the stray field of the principal machine in one direction or the other, produces a variation of the field of the exciter, and generates in this latter a regulating current which corrects the excitation according to the extent and direction of the variations of load. This mode of construction, or a similar arrangement, may be employed in all cases where a magnetic co-relation is established between the two machines; in other words where the exciter is mounted on the shaft of the principal machine, either inside or outside of the frame. In the latter case the foundation plate, common to both, suffices for closing the magnetic circuit of the stray fields common to both machines and it will be necessary merely to increase a little the stray field of the principal machine by making the dissymmetry of structure in the machines a little more pronounced.

Series vs. Parallel Windings in Alternating-Current Motors.

By R. E. Hellmund.

Most engineers are of the opinion that it is much better to connect all parts of the winding of an alternating-current machine in series than to use parallel connections; and in many cases they seriously object to machines with parallel connections. While this objection may be justified in cases of generators, the writer is of the opinion that in case of motors parallel connections are as a rule just as good if not better than series connections.

Consider first what happens in a motor with all parts of its winding for one phase connected in series. An e.m.f. of a certain amplitude and wave-shape is impressed upon the motor terminals; the flux within the motor will adjust itself so that the geometrical sum of the ohmic drop and of the induced counter e.m.f. is equal in amplitude and wave-shape and opposite in direction to the impressed e.m.f. because this is the only possibility for establishing a state of equilibrium. In the case of a series winding the current through all parts of the winding is by necessity the same. If, now, by inexactness of workmanship, for instance, by an eccentricity of the rotating member, the magnetic reluctances in the paths of the various fluxes which

are interlinked with the different parts of the winding are different from each other, the necessary consequence is that the fluxes at different parts around the rotating member will be different in value, since the magnetomotive force is the same in all parts. The effect of an unsymmetrical field is different in different kinds of machines. In single-phase commutator motors, for instance, it is possible for the flux interlinked with the coils between two sets of armature brushes to be unsymmetrical while the total value of the fluxes between the sets of brushes may be equal to each other in their total value. If this is the case the only disadvantage caused by the irregularities of the field is that the armature is pulled magnetically into a certain direction whereby the strain upon the mechanical parts of the machine as well as the friction may be considerably increased. It is known that the magnetic pull is proportional to the differences of the squares of the densities and proportional to the differences in the length of the air-gap. If, moreover, the irregularities of the field are such that the total amounts of fluxes between the different sets of brushes are not equal to each other, the potential induced in the different armature parts between the brushes are no longer equal to each other, and consequently there will be internal currents flowing in the armature which of course cause heating losses and may also have a bad influence upon the commutation in certain cases.

In induction motors with an almost synchronously rotating and short-circuited secondary an unsymmetrical field is not possible. There will always be currents produced in the secondary which maintain the same field shape and amplitude all around the air-gap. These secondary currents mean, of course, a certain loss in the secondary.

Compare now these facts with what happens in case of windings with parallel parts, for example a machine in which the winding is divided in as many groups as there are pairs of poles and in which all of these groups are connected in parallel. In this case the counter e.m.f. induced in each of the branches must be equal in wave-shape and amplitude and opposite in direction to the impressed e.m.f. This, however, is possible only when the fluxes of all the parts are equal to each other. If, therefore, the reluctances of the various parts are different from each other, the magnetomotive forces—that is, the magnetizing currents of the different parts—must be different from each other. In this case the copper losses in the winding are somewhat larger than they would be if the same average current would flow throughout all the parts of the winding as in case of a series connection. There is, however, a symmetrical field and therefore no currents and no losses will be caused in the secondary; the unbalance in the magnetic pull will be proportional simply to the difference in the length of the air-gap, the densities being symmetrical all around the air-gap.

It is seen from the previous considerations that an irregularity in the air-gap of alternating-current motors always causes some additional losses. In almost all cases it causes additional copper losses; the choice of series or parallel connections in the windings causes a difference only in so far as it determines the member in which these copper losses occur. The additional friction losses will be rather larger in case of a series connected field winding than they will be in case of parallel connections; in most cases, however, especially in induction motors, there will be hardly any noticeable difference at all.

In certain multipole commutator motors the series connection of the field coils may be more liable to cause commutation troubles than the parallel connection.

Irregularities of the air-gap are, of course, not the only causes for trouble. In smaller motors with many turns per coil it may occur that the coils are wound by mistake or through carelessness with a different number of turns. In this case the phenomena are very much the same as in case of an unsymmetrical air-gap.

Another irregularity in the windings may be caused by the fact that the end connections of different groups of coils are different in length or otherwise magnetically different. This as a rule has little influence on the performance of the motor when running, while, especially in case of induction motors, it may influence the starting condition to a certain degree if there are parallel circuits in the primary. The difference in the end connections may cause the leakage to be different in various groups of the winding and in case of parallel connections the current in the various groups may be different, whereby additional losses are caused. This disadvantage is in most cases, however, not very serious.

One case in which parallel connections may be of disadvantage is found in the synchronous motor, because there the field is determined not only by the impressed potential, but also by the field excitation. Therefore, it is possible that in case of parallel connections in the armature additional copper losses may occur, which might be prevented by serious connections.

The comparison between parallel and series connections given above applies in a similar way to the closed and open connections of polyphase motors (delta and star connections in case of three-phase motors). Of course, on account of the large number of motor types and the numerous causes for irregularities, it is impossible to make any general statement as to which winding should be preferred; but as a rule there seems to be no reason for preferring for all machines a series connection to a parallel connection, or an open connection to a closed connection in case of motors, as is very frequently done at present.

Electrical Distribution at Wellesley, Massachusetts.

The town of Wellesley, Mass., has recently completed a new distributing sub-station in connection with the supply of current by the Edison Electric Illuminating Company, of Boston. Although the equipment of the installation is of a simple character, its arrangement typifies the tendency of the times toward concentration of generating and distributing facilities in large metropolitan systems. The absence of complication in the Wellesley sub-station is in itself an evidence of the advanced stage which has been reached in the supplying of an entire town with electricity on much the same kind of a contract as would be acceptable to an individual consumer.

Wellesley is one of the most attractive suburbs of Boston,

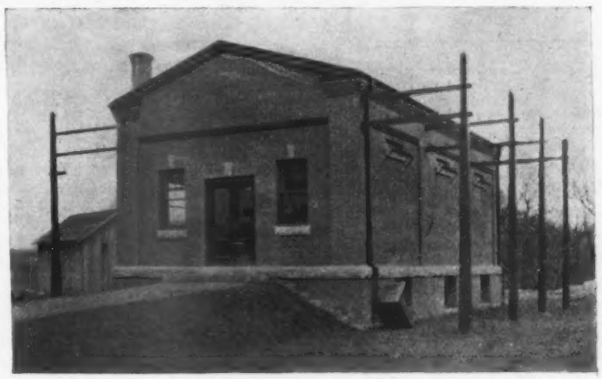


FIG. I.—NEW DISTRIBUTING STATION, WELLESLEY HILLS, MASS.

lying about 15 miles west of the city proper and having a population of about 5,500. It is the seat of Wellesley College, and it is inhabited largely by well-to-do residents whose business interests center in Boston. In October, 1905, a seven-year contract was signed with the Boston Edison Company for the supply of electricity at rates which would deliver the current at a distributing station to be built by the town at Wellesley Hills Square, at 6 cents per kw-hour or thereabouts, depending upon the consumption. All the current for the town is generated at the L Street plant of the Boston Edison Company in South Boston and transmitted to Wellesley via Newton. At

Newton the voltage is reduced from 6,600 to 2,300, the last two miles of the run being at the lower potential over a No. 2-0 four-wire, three-phase line which connects the Wellesley Hills and the Newton sub-stations.

The new sub-station at Wellesley was designed by French and Hubbard, of Boston, consulting engineers. It is a one-story and basement brick building about 40 ft. by 24 ft. wide, with concrete floors and a concrete roof supported on four steel trusses. A central skylight of wired glass furnishes an admirable supply of light in the operating room. The 2,300-volt supply circuit from Newton is brought into the building on a pole line on the west, or left-hand side facing the door; the local distributing circuits for commercial service are carried out upon the same side of the building after passing through the main switchboard, and the municipal street lighting lines are carried out upon the opposite side of the building. The basement is used as a storage room and workshop of the town's electrical department.

The main switchboard consists of six marble panels mounted near the west wall. The three-phase, four-wire line enters the building through bushings passing through a soapstone panel in the wall, is tapped for lightning arresters directly under the entrance panel, and cut in or out from the switchboard by three single-pole knife switches mounted behind the first panel. A

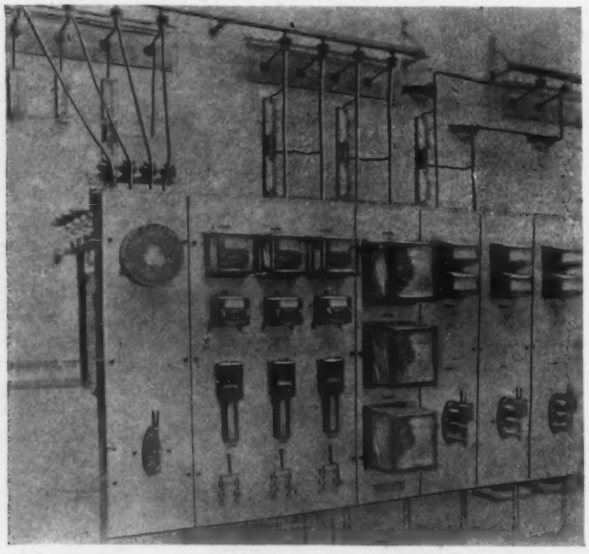


FIG. 2.—MAIN SWITCHBOARD, WELLESLEY HILLS SUB-STATION.

hand-operated oil switch and three-phase ground detector occupy the first panel—the extreme left-hand slab, facing the board—so that the bus-bars in the station may be "killed" whenever it is desired to cut off the current. Automatic oil switches are used only in the outgoing feeder circuits. The second panel is a totalizing panel, and it carries six Thomson 60-cycle induction wattmeters, three Wright-demand meters and three double-pole switches. Three of the wattmeters are used in measuring the total input of the sub-station, and with the demand meters are read regularly by the Boston Edison Company as the basis of monthly bills. The switches on the panel are for the purpose of cutting these wattmeters in or out in case it is desired. The second set of wattmeters is connected with the bus-bars beyond the taps for the municipal lighting circuits, so that the total reading of these instruments gives the salable kw-hour output, including losses. The third panel carries three 110-volt curve-drawing voltmeters, and the last portion of the board is made up of three duplicate commercial feeder panels, with a 60-amp. Thomson ammeter, a voltmeter and an automatic oil switch upon each. General Electric equipment is used throughout and the local distribution is all accomplished by 2,300-volt, single-phase circuits.

The town street lighting is furnished by 25-cp series incandescent lamps, operated from five 3.5-amp., 17.5-kw, 2,300-volt, constant-current transformers. The leads supplying these transformers are carried down behind the main switchboard beneath the floor and across the basement ceiling to the individual switchboard panel bus-bars common to the tube. These panels are four-wire, three-phase lines carried on the basement ceiling.

The wiring throughout the sub-station is admirably straightforward, with a predominance of horizontal and vertical runs. The only serious criticism that offers itself is in connection with the location of the main knife switches behind the first panel of the main board. It would seem that as these carry a potential of 2,300 volts, at least on one side, that the better location would have been upon the wall behind the switchboard, where accidental contacts would be out of the question. The absence of all rotating machinery and the simplicity of the equipment reduces the operating labor cost to a minimum, and this is a point well worth securing in a suburban station where total loads are small and the room for increased business large.

Electricity in a Curtain Factory at West Newton, Mass.

An interesting example of the benefits of electric driving of small machines in groups is found in the plant of the Martin Manufacturing Company at West Newton, Mass. About a year and a quarter ago the company moved into a new building 160 ft. long by 60 ft. wide, and it now has about 160 employes engaged in the manufacture of the Echo Bridge branch of curtains and bed sets. The present production is about 12,000 pairs of curtains per week, the goods varying in weight from about 10 to 15 yards per pound.

The factory building is an excellent piece of mill construction and it was designed by Messrs. Lockwood, Greene & Co., of Boston. At one side of the plant a 50,000-gal. steel tank has been set upon a steel tower for supplying water for fire purposes, and the whole plant is thoroughly sprinkled. Special care has been taken in the installation of the machinery to protect the operators from accident.

Power is purchased from the Newton & Watertown Gas Light Company's Homer Street sub-station, whence it is de-

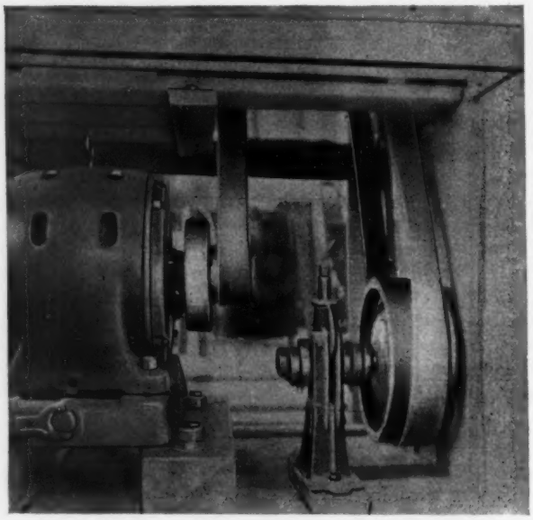


FIG. 1.—MOTOR UNBOXED AND ARRANGEMENT OF SHAFT-DRIVING EQUIPMENT IN OPERATION.

livered after transmission from the L Street generating station of the Boston Edison Company. A three-phase circuit carrying 110-volt, 60-cycle alternating current is brought into the basement of the factory by a cable which connects with two 2,300-110-volt transformers mounted on a pole outside. The three-

phase line passes through a main switch and cut out as soon as it enters the factory, and is then divided into two circuits for power and lighting, the usual demand meters and recording wattmeters being inserted in each line. From the meters the various circuits lead to the street floor and second story, the factory being a two-storied structure.

The most striking feature of the installation is the small amount of power required to operate the machines in use. The main workroom contains 143 machines of different types, driven in three sets. Three General Electric 110-volt, three-phase, 3-hp induction motors running at 1,800 r.p.m. operate the entire plant. Each of the motors is mounted upon a solid timber foundation set on the floor, and drive an overhead shaft by direct belting. From the overhead shaft near each motor a pair of belts is brought down to a low-running horizontal shaft near the floor, one shaft being located on each side of the aisles between the sets of machines. The various machines are driven directly from the low horizontal shafts by short connecting belts. One motor drives 42 sewing machines of different types for curtain work, and also a cutter and grindstone; the second motor drives 42 sewing machines and a counter and the third drives 59 sewing machines, lace machines, 3 fluting machines and French curtain machines. Ten electric flatirons are used in the

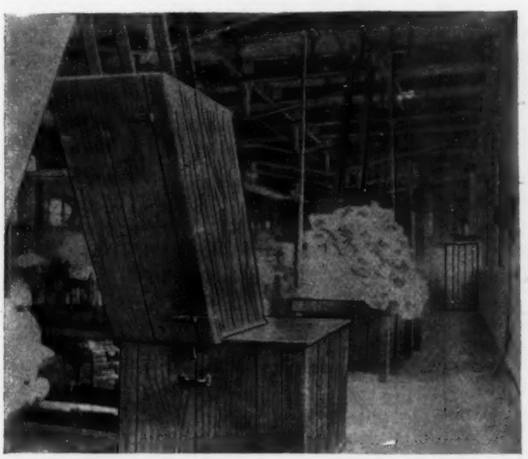


FIG. 2.—METHOD OF BOXING IN MOTORS AND BELTING TO PROTECT OPERATIVES.

plant and special electric heaters are used on the fluting equipment. The heaters were supplied by the Simplex Electric Heating Company, of Cambridgeport, Mass.

The mechanical arrangement of the shafting, pulleys and belts is largely responsible for the small amount of power required. Each motor is boxed in so that it is impossible for a girl operator to become entangled in the moving machinery, and special care is taken to box in the belts to a height of about 7 ft. above the floor. The motor boxes are provided with doors and sides which can be taken off in a few seconds, so that a motor or its pulley, bearings and belts can be examined with the minimum of trouble. The line shaft of each group of machines is also readily accessible. Each motor is started by a double-throw triple-pole switch which throws half voltage upon the windings in beginning operation, full voltage being applied as the machines speed up toward normal. Before the plant was installed the cost of power was estimated to be about $58 per month, based on each machine being in operation 60 per cent of the time. The plant runs 58 hours per week, and it has been found that the power cost varies from $58 to $60 per month, exclusive of the electric heating and lighting. At present the lighting is done by gas "arcs." The cost of power, including the fluters and the flat iron service, runs to about $85 or $88 per month. The induction motors require very little attention, and they operate very satisfactorily. The company in advertising for new employes refers to the use of power-driven machinery in its equipment.

1200-Volt Direct-Current Street Railway.

Early in the winter the Albuquerque Traction Company, of Albuquerque, New Mexico, found it necessary to move its generating station from the old station beside the tracks of the Sante Fe Railroad, to the grounds of the American Lumber Company, just outside the city limits. As the new site was fully ten times as far from the center of distribution as the old station, the question of voltage regulation immediately became a serious one.

After considering the matter of copper required for some time it was decided to employ a system of distribution much similar to the Edison three-wire system, simply using the trolley and feeder wires to carry the high voltage and using the track for the neutral. This arrangement was effected by inserting an insulating breaker in the trolley in the immediate vicinity of the center of distribution.

The two 600-volt Crocker-Wheeler generators were then connected in series, the wire connecting the machines being connected with the track, while the two outside wires were connected to their respective positions on the two trolleys. The neutral wire was grounded at the station a distance of 2,000 feet from the nearest section of the track, the grounding being accomplished by sinking a piece of boiler plate six feet square in the ground about one and one-half feet below the water mark.

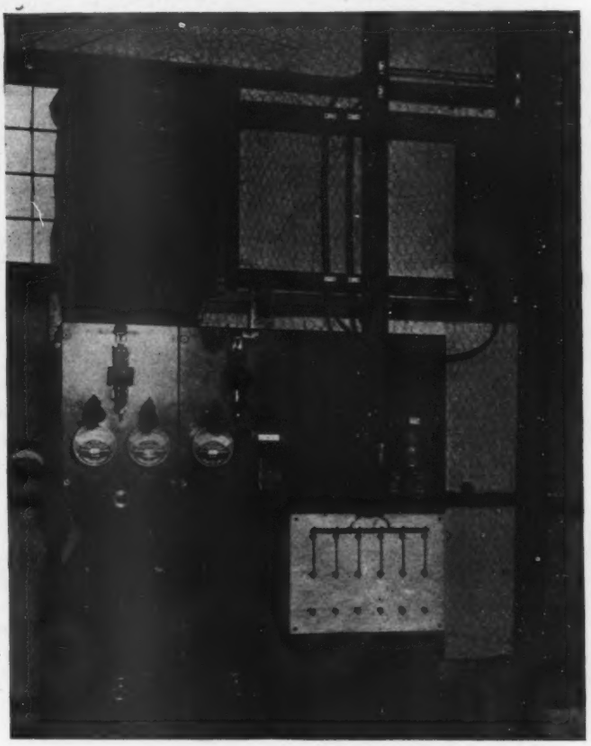


FIG. 1.—SWITCHBOARD.

Fig. 1 shows the switchboard at the station and Fig. 2 shows a section of the transmission line. The large double-throw switch shown in Fig. 1 when thrown up connects the generators in series and operates the system with 1,200 volts; and when thrown down, both generators are placed in parallel. When one generator is cut out, the other generator operates the whole system on 600 volts.

It will be readily seen that when the system is operated on 1,200 volts the high-voltage wires serve the purpose of transmitting the current and that there is not more than 600 volts between the trolleys and the track at any time.

This system was designed and constructed by Mr. A. D. Coleman, the electrical engineer of Albuquerque, and was put

in operation about Dec. 15 last. Besides effecting an enormous saving in copper, the system makes a great improvement in the voltage regulation of the system. In fact, it is claimed

FIG. 2.—VIEW ALONG TRANSMISSION LINE.

that while the generators are much further from the center than before, it is a great deal easier to keep the cars up to the time schedule than formerly.

Recent Electrochemical Developments.

In the Castner process for the electrolytic production of metallic sodium from molten caustic soda it is important to maintain the temperature at not more than 10° or 20° above the melting point of the bath. The reason is that at higher temperatures the metallic sodium formed is redissolved in the electrolyte and the efficiency rapidly decreases. The same idea is evidently at the bottom of a recent patent of G. O. Seward and F. von Kuegelen, who, however, electrolyze fused common salt instead of caustic soda. If such a process should be commercially successful, the use of the cheaper starting material would result in an essential reduction of the cost of metallic sodium. Seward and Kuegelen state that the higher the temperature of the bath, the less the efficiency, and in order to be able to use a lower working temperature, they artificially lower the melting point by additions to the bath. In the choice of such additions one is restricted by the requirement that the added salt should be inert; i. e., should not be decomposed by the current together with the sodium chloride. The electrolyte which Seward and Kuegelen use, consists of four parts of sodium chloride, two parts of sodium fluoride and one part of barium chloride.

Various recent patents refer to the treatment of sulphide ores. C. E. Baker and A. W. Burwell treat lead sulphide, zinc sulphide or copper sulphide by heating the pulverized ore in an atmosphere of sulphur chloride. The reacting yields sulphur and the chloride of lead, zinc or copper. In the case of lead and zinc the chloride is obtained in molten state and electrolyzed in this condition with graphite anodes and molten lead or zinc cathodes. In the case of copper, the cuprous chloride is leached out and the aqueous solution is electrolyzed.

John H. Ryan treats ores containing copper, nickel or cobalt in combination with sulphur or arsenic by first roasting and then discharging them into a dilute solution of sulphuric or sulphurous acid for the preparation of a sulphate or sulphite solution. The metals are then recovered by chemical precipitation and electrolysis.

R. S. Packard wants to convert copper or zinc sulphides into sulphates by means of chlorine set free from a strong hydrochloric acid or a strong brine solution. His idea is that the chlorine set free would react with the water, and form hydrochloric acid and nascent oxygen, the latter producing the conversion to sulphate. The copper sulphate is then leached out and the copper recovered from the solution.

New Telephone Patents.

TRUNK CIRCUITS.

As is well known, the two-wire system of switchboard circuits has been largely exploited by the independents. Heretofore their plants have involved few branch exchanges and it is but recently that the subject of trunking has needed much attention. Now, however, patents for trunk circuits adapted to these systems are rather frequent. In improving an existing trunk scheme, Mr. W. W. Dean has patented a circuit wherein the busy-test relay usual with such systems is cut off by a special relay. This relay is in series with its own contact and in addition with contact of a double-wound relay and battery. Through one winding this relay is actuated whenever a connection is up at the calling end of the trunk. Through its other winding it is actuated as long as the called subscriber's telephone is off the hook. From this it will be understood that as long as the double-wound relay is actuated the test cut-off will also be actuated provided only that the latter's own contact be once closed. This closure is effected by an auxiliary contact on the ringing key by which the act of ringing on any trunk closes an auxiliary shunt about the contact of the test cut-off relay. When the ringing key is released the cut-off circuit remains energized.

Another trunk circuit involving improvements is the invention of H. G. Webster, of Chicago. In this circuit the disconnect signal circuit is so arranged that the current supply for this purpose to all trunks of any position is common and may be led, therefore, through a pilot relay. Both these patents are assigned to the Kellogg Switchboard & Supply Company.

NEW APPARATUS.

Probably no part of the telephone equipment has been given more consistent attention of late than protective apparatus. As always, there are two parties, the one favoring more and better protective devices and the other favoring less or none at all. Just at present the balance is swinging toward the "more" idea. To offset the troubles incidental to the added parts, more and more attention must be given to the details of these. A form of sub-station protector is shown in Fig. 1,

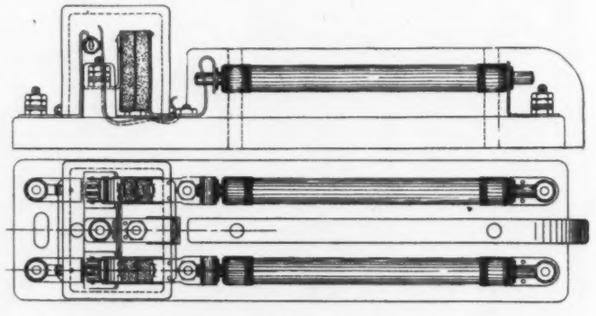


FIG. 1.—COOK PROTECTOR.

recently patented by F. B. Cook, of Chicago. This embraces a number of novelties. It will be seen at a glance that the protection includes tubular fuses, open-space cut-outs and heat coils. The fuses mount in spring terminals without screws and are separated by a screen. The heat coil is of the self-soldering type, so that after operation it is only necessary to rehook the front spring to restore the parts for service.

An improvement in drops has been made by H. J. Kusel, of Chicago. This consists of a loose key arrangement for fixing relatively the drop-hook shaft and the armature. Normally,

both must swing together, but for repair, especially with a combined jack and drop apparatus, it may become advisable to swing the shutter temporarily out of the way. In this improved drop the loose keys are shifted and the armature thus released, free to swing upon its support without reference to the drop-hook. It will, of course, be understood that the armature swings free upon the hook shaft when the keys are released.

M. V. Mehren has obtained two patents for a combined drop and jack with a mechanical self-restoring feature. The invention concerns details of construction, a pivoted lever engaged by the plug shoulder kicking the shutter up home. Both patents are assigned to the Eureka Electric Company.

SWITCHBOARD CIRCUITS.

A patent has been granted to F. W. Dunbar for a two-wire circuit for a multiple switchboard, assigned by him to the Kellogg Switchboard & Supply Company. This is shown in Fig. 2. The action is very simple. When a station calls the

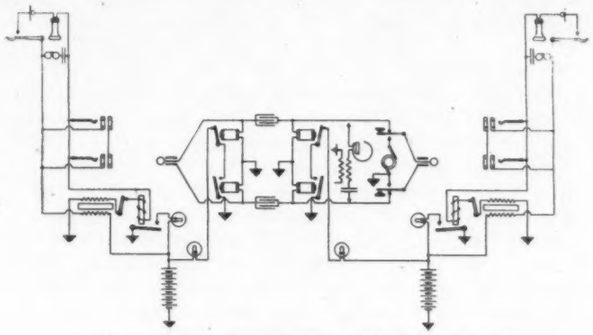


FIG. 2.—DUNBAR TWO-WIRE SWITCHBOARD CIRCUIT.

line relay operates, but the cut-off relay fails, being differential, the coils being in series and thus carrying the same current. The response of the operator shunts one coil, destroying the balance, and thus causing the cut-off relay to respond. The control of the supervisory lamps is as usual. The plug connects the test ring to the battery, as indicated.

Another patent assigned to the same company covers a trunk circuit invented by W. W. Dean. This is worked out for the Dunbar type of two-wire system and provides the usual signals. The novelty lies in the control of the busy test circuit.

PARTY LINE RINGING.

Mr. Dean has also obtained another patent for his harmonic ringing system. The gist of the invention was noted in a comment covering the patent for the form of bell used, a few weeks since. The present patent covers the ringing system using this bell, and is assigned to the Dean Electric Company.

A step-by-step system forms the subject of a patent issued to H. R. Turner, of Hoxie, Kan. This has the usual features of a dial to set and a mechanism at each station to do the switching. An intercommunicating system for factory and similar use has been patented by B. O. Fox, of Milwaukee. The switching is done by push buttons which are locked and released according to the position of the switch hook.

LETTER TO THE EDITORS.

Single-Phase Railway System.

To the Editors of Electrical World:

SIRS:—Permit me to call your attention to an error in your account of my contribution to the discussion on Mr. Stillwell's paper before the recent meeting of the A. I. E. E. This report is in your issue of February 2nd, and the error occurs in the following sentence: "From the standpoint of self-containment, the position of the direct-current motor need not be yielded to the alternating current." The point which I made, and which will be obvious in the Institute's report, is that the single-phase system, allowing as it does greater distance between sub-stations, less copper in the line, less complicated apparatus in the sub-station, and also less attendance, is much more nearly self-contained than the direct-current system.

BALTIMORE, MD. J. B. WHITEHEAD.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Magnetic Leakage in Alternators.—CRAMP.—The second part of his paper on magnetic leakage and its effect in electric design. In discussing alternators he refers to the design of constant-current machines and suggests that armature reactance should in every case be kept as small as possible, while reactance of the armature upon the field should be allowed to cause the latter to leak and thus produce the constant-current effect. The same idea may be adopted to cause the alternator to be self-compounding. His method is specially applicable to alternators of the inductor type, and may be explained as follows: Fig. 1 is a section through a special inductor alter-

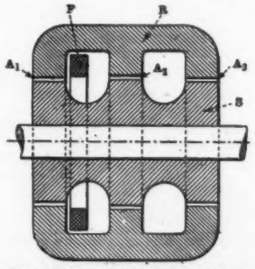


FIG. 1.—CROSS-SECTION OF INDUCTOR ALTERNATOR.

nator. R is the stator or stationary armature, forming also part of the magnetic circuit. S is the rotor, and would carry normally the rotating inductors to produce the necessary variations of flux. A_1, A_2, A_3 are air-gaps, and it is evident that if F is the only coil producing the magnetic field, then A_1 and A_2 are magnetically in series, as also are A_1, A_3, while A_2 and A_3 are magnetically in parallel with respect to A_1. Suppose, now, that the armature coils are wound upon the stator at A_2, while the other two air-gaps remain as simple smooth-bore flux paths. If F be excited by a constant current the coils A_2 will generate a certain open-circuit e.m.f. when R rotates at a certain speed, depending upon the relative areas of A_2 and A_3. Directly any current is taken from the coils at A_2 armature reaction is set up which immediately increases the reluctance of the path of the field flux through A_3. In consequence more of this flux tends to leak by A_3, producing thereby a very large fall of voltage, which will tend to keep the current at A_2 constant. This is particularly the case if the air-gap at A_2 be small and the density high with respect to A_3; so that by carefully adjusting the areas of the gaps and the densities an alternator may be so constructed that a very small change of current through the coils at A_2 only takes place, even if the resistance in circuit with these coils is changed from a large value to short-circuit. Similarly, if the armature coils be placed at A_3 a still more pronounced effect is obtained. Complete regulation and control of this effect is obtained if a second field coil be placed in the recess between A_2 and A_3 and connected in parallel with F. A resistance and reversing switch in series with this second coil will enable all the changes to be produced from an alternator having practi-

cally a constant-current characteristic to an alternator having the characteristic of a machine intended for ordinary constant potential supply. If the two field coils are so adjusted as to both tend to make A_1, A_2 the path of their flux, the effect of the second field coil is equivalent to a great reduction of the reluctance at A_2, while when the two are in opposition they both send their flux through A_2, and tend to prevent any possibility of leakage. Thus in either case the armature at A_2 may be wound as if for constant potential In applying these principles to obtain a machine which shall, with varying currents, give constant potential difference, we should have to provide at A_3 a steadily increasing magnetomotive force of such sense that it would oppose the leakage from F. This is equivalent to compounding in the ordinary way, and, in consequence, involves a continuous current increasing with the load. In order to compass this, and also to make use of the air-gap A_3, the author places on the rotor at A_3 a continuous-current armature and commutator, and breaks up A_3 into salient poles. The brushes on the commutator being connected through suitable rheostats to the field coil F, the machine is self-exciting. Not only this, but the increase of alternating current at A_2, by tending to increase the reluctance of that path, tends also to shunt more flux via A_3, whereby the voltage at the commutator is increased and with it the exciting current, so that the voltage at A_2 returns to its original value. In this way the machine becomes both self-exciting and self-regulating; self-regulating not only as regards voltage drop due to increase of current on the alternating side, but also as regards change of power factor involving no change of current. For if the power factor of the alternating-current circuit be reduced, the armature reaction at A_2 is increased, which normally causes a fall of potential difference, but in this case automatically compounds itself by increasing the exciting current. Moreover, the machine may actually be made so that it over-compounds, the question of the amount of compounding depending simply upon the saturation of the iron paths at A_2 relatively to those of A_3. Fig. 2 shows a section through an actual ma-

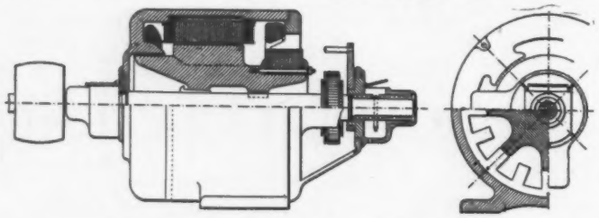
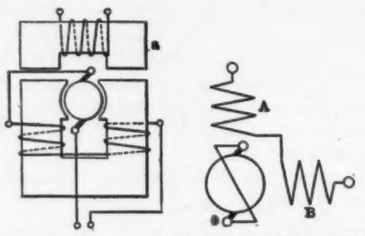


FIG. 2.—SECTIONAL VIEWS OF ACTUAL MACHINE.

chine constructed upon these principles. When constant current is required, instead of reducing the reluctance at A_3 (Fig. 1) we may increase the reluctance at A_1. This is very easily carried out if the exciter armature be placed at A_1, for then any increase of current at A_2 increases the reluctance of the whole magnetic circuit sufficiently to drop perceptibly the exciting e.m.f. In this case, then, the air-gap A_3 is not required, but it may be of use in order to give (by allowing a second field coil between A_2 and A_3) a better magnetic distribution at A_3. If the alternator armature be supplied with an alternating current while the rotor is run up to speed, the machine will run as a synchronous motor because the direct-current armature will excite and set up a field current. When in synchronism, increase of load will tend to strengthen the field magnetism by reducing the reluctance upon the synchronous-motor side, so that the machine will automatically compound for fall of voltage upon the direct-current side. Thus we have a motor converter with its direct-current voltage completely under control and tending to automatically compound, while economy and efficiency are obtained by the use of one field coil for the two armatures. In passing over to the discussion of alternating-current motors the author first refers to motors without salient poles, like induction motors and repulsion motors, and draws attention to the very low values of the leakage factor in the same. He then explains how useful magnetic leakage may be employed in a modification in a series alternating-current motor. If having designed an ordinary series bi-polar motor such as that shown in Fig. 3, one applies



FIGS. 3 AND 4.—DESIGN OF BI-POLAR MOTOR.

to its top another limb like a, properly wound, and attached to the mains; and if then the free end of the present field is joined to the free brush, the main and leakage magnetic paths of the new motor will be in parallel exactly as they are in an ordinary induction motor; with these differences (1) that in an ordinary induction motor the torque is produced by the main field and the rotor current, while here it is by leakage field and rotor current; and (2) that in an ordinary induction motor all the brake-horse-power has to cross an air-gap, while here only part need cross it. The new primary coil will have a very small resistance, and consequently at constant terminal volts the flux through it will be practically constant and the magnetizing current practically constant also. Some of the vectors in the circular diagram are slightly changed in length and phase. Otherwise the motor remains precisely as before, excepting for the fact that we may wind the high-tension side for any voltage we please, and we may regulate entirely on the low tension, which windings might be stocked for each size. Also this very change admits of possibilities of improving the slightly reduced power factor and of immensely improving the commutation by altering the number of armature and leakage limb turns respectively. The nearest parallel to the above motor in use at the present day is the repulsion motor represented diagrammatically in Fig. 4. In this motor the short-circuited armature is fed through induction by coils A, while coils B provide the field flux. A and B are placed in series across the mains. When the locked test is applied to such a motor it is seen that the coil A is relatively non-inductive compared with the coil B; hence a phase displacement of flux takes place, setting up a rotating field somewhat similar to the starting system of an ordinary single-phase induction motor; and in order to take full advantage of this a stator without salient poles like that of an ordinary induction motor must be provided. A comparison of Fig. 3 and its modification reveals the fact that for electrical circuits in series magnetic circuits in parallel are used. Also we note that in Fig. 4 not only has a flux at B to cross the air-gap, but also a flux at A, so that the whole energy imparted to the rotor has to cross the air-gap. This is the secret of the low power factor obtained with repulsion motors. The author finally gives the following table of comparison between four motors. Results of tests of the new motor are promised for

	Series motor simple	Series motor with transformers	Repulsion motor.	Cramp motor.
Suitable to voltage..	Low only	Any	Any	Any
Power factor	Good	Good	Fair	Good
Commutation	Depending on voltage	Good	Only good at sync.	Very good
Iron weight.....	1	1.75	1.1	1.25
Copper	1	1.75	1.3	1.25
Easy to wind.....	Very	Moderately	No	Very
Compensation coils required	Yes	No	No	No

a publication in the near future.—Lond. *Elec.*, February 1.

Single-Phase Motors.—Speyer.—The first part of an article illustrated by diagrams on single-phase induction and single-phase series repulsion motors. The former has a constant speed irrespective of the load, but no starting torque. The latter has a strong starting torque, but its speed varies with the load. To combine the favorable features of both motors

has been tried by various designers like Schueler, Fynn and Osnos. The author begins to give an account of the working of the Osnos and of the Schueler motors. The article is to be continued.—Lond. *Elec. Eng.*, February 1.

Three-Phase Turbo-Generator.—KOLBEN.—An English translation of the German article recently noticed in the Digest, on the design and behavior of a 50-period, three-phase turbo-alternator for 970 kilovolt amperes running at 1,500 revolutions per minute and giving 720 amperes at 450 volts per phase. —Lond. *Elec. Eng.*, January 25.

Power.

Electric Stations and Destructor Works.—ABRAHAM.—An article on the advisability of combining electricity and destructor works in small towns. The author gives some results obtained at Cambuslang with their electricity and destructor works where there is not yet a battery so that on this account the destructor is badly handicapped, as they have to run machinery from refuse for 24 instead of 8 hours per day. "This means that instead of banking fires for 16 hours daily and burning refuse to the very best advantage for the remaining 8 hours, they have to keep engines running round practically light for 16 hours a day, and this naturally wastes a great deal of refuse." In spite of the above disadvantages with 72 tons of refuse per week they generate some 2,520 units by refuse, leaving only 716 units for coal. This works out at 35 units per ton of refuse destroyed. The destructor has been working since June, 1905, and nothing whatever has been spent for repairs. The author is quite sure that it would be easy to generate 50 units per ton of refuse under ordinary working conditions, and it is safe to rely on 40 units per ton of refuse provided the station is properly designed. The boilers should be worked at a steam pressure of 200 lb. per square inch and the engines should be supplied through a reducing valve with steam at 150 lb. per square inch; a good-sized battery is also an absolute necessity. Thde two smallest sets should be steam balancers if the scheme is a three-wire one. However, in small compact towns a simple two-wire system is the better for several reasons. On the other hand, combined electricity and destructor works installed in large towns, or even towns of, say, 40,000 or 50,000 inhabitants have, in all cases up to the present, been a failure or a comparative failure, the more the load grows in the electricity part of such schemes the greater will be the necessity for moving the destructor away. In large go-ahead towns the electric light load comes up to such an extent that the steam from the destructor is a negligible quantity. In larger towns, for a combined electricity and destructor scheme at least twice the refuse which the town is able to supply is required. If such a town could obtain the refuse from a neighboring city on suitable terms, then the author thinks there is no reason why the electricity supply should not be provided almost entirely by refuse and be as successful as in small places. As regards the type of destructor, the author has had working experiments of both top and front feed cells, and greatly prefers the latter ones.—Lond. *Elec. Rev.*, February 1.

Coal.—SCHELLENBURG.—A paper read before the Engineers' Society of Western Pennsylvania on "Our Coal." The United States has produced 6,000 million tons of coal and the annual rate now is 400 millions, against 200 millions in 1897 and 100 millions in 1882. Besides our annual production of 80 million tons of Pennsylvania anthracite we get 200 million tons of bituminous coal from Pennsylvania and Maryland; the sixth part of which 200 millions is made—in Pennsylvania and West Virginia—into coke, being fully 25 per cent of the country's production of coke. Alabama, Virginia and Colorado make another 15 per cent. The annual production of coke has quadrupled in the last 25 years and is now about 33 million tons. Nine-tenths of all is yet made in bee-hive ovens. Coke is mainly used for smelting iron ore, in a total production for the United States of 23 million tons of pig iron last year. The author gives a general review of the geology of coal and the methods of mining coal.—*Proc. Engineers' Soc. of Western Pa.*, January.

Steam Plant in Geneva.—A note on the erection of a steam-engine central-station in Geneva which serves as a reserve to the water power plant of Chevres. The reasons why a steam plant was chosen although large water powers are still available in the neighborhood are given. They are essentially due to the fact that the power available from water is extremely variable at different periods of the year.—*L'Ind. Elec.*, January 10.

Nice.—A fully illustrated description of the generating plant of the gas and electric company of Nice which is the first electric plant in France in which Curtis steam-turbines are installed. The plant contains two turbo-alternators each of 800 kw., producing three-phase currents at 10,000 volts with a frequency of 25. The plant has been in continuous operation for more than a year and has proven very satisfactory.—*L'Ind. Elec.*, January 10.

Hydroelectric Plants in Italy.—PERKINS.—An illustrated description on the new hydroelectric transmission plant on the Ticino river in Northern Italy from which a number of cities like Milan, Pavia, etc., are supplied with energy. The plant has a capacity of about 8,000 hp. Three-phase currents are generated at 2,700 volts with a frequency of 42. For transmission the voltage is raised to 25,000. There are nearly a score of transmission lines connecting the power station with the various towns and cities.—Lond. *Elec. Eng.*, January 25.

Electric Power in Saw Mills.—REINER.—In saw mills there are often very great variations of the power load which would make the supply of motors and lamps from the same network impossible. To overcome this difficulty the author connects the motor with a fly-wheel by means of a band-coupling. This device has been found perfectly successful. The fly-wheel has a momentum equal to 15 times the energy consumed per second by the motor. The figure 15 was found by experiment.—*Elek. und Masch.*, January 20.

Traction.

Petrol-Electric Transmission for Road Vehicles.—HART AND DURTNALL.—Their paper (the first part of which was already abstracted in the Digest) read before the Society of Motor Omnibus Engineers. In the second part of the paper they describe their own system which is distinguished from all others as it employs a three-phase system. The special advantages are that induction motors are simpler and more compact than direct-current motors and have no commutator with a possibility of sparking, which is a point of greatest importance for motor vehicles carrying inflammable material such as gasoline. Further, a polyphase induction motor running above synchronism becomes a generator and absorbs mechanical power and thus acts as a brake. The construction of the car is shown in Fig. 5. *A* is a 40-hp petrol engine (speed 800 revs. per min.); *B*, fan; *C*, polyphase alternating-current generator, combined with a series-wound exciter; *D*, electromagnetic clutch, to obtain direct drive on top speed (800 revs. per min. of engine equals 12 miles per hour); *E*, polyphase alternating-current induction motor, coupled direct by means of—*F*, propeller shaft, fitted with universal compensating joints to—*G*, live back axle, fitted with differential gear, etc.; and *H*, bolts to carry the whole plant, which is slung from the cross members of the chassis. Other parts shown in the diagram are: *I*, connections; *J*, exciting revolving field magnet of polyphase-current generator; *K*, armature of small continuous-current series-wound exciter; *L*, sectional field of exciter; *M*, winding of electromagnetic clutch; *N*, regulating switch and contacts in connection with sectional field; *O*, bridge contact-piece for short-circuiting generator field; *P*, contacts for bringing into circuit magnetic clutch windings; *Q*, fixed armature winding in polyphase generator; *R*, fixed "stator" two-speed windings; *S*, "rotor" of polyphase motor, with short-circuited bar winding; *T*, bridge contact in connection with the foot brake pedal; *U*, reversing switch, and *V* two-speed switch for starting on

gradients. The method of operation is that, assuming the engine is running at constant speed, the switch is on the forward position, the two-speed switch is on the top electrical driving speed, and the regulating switch is on position 1, no voltage being available, the driver places the switch on No. 2 contact, and a low voltage is generated, which excites the alternator field, which, in turn, generates polyphase alternating current in the generator armature winding, whence it is conducted by copper bars through the reverse and two-speed

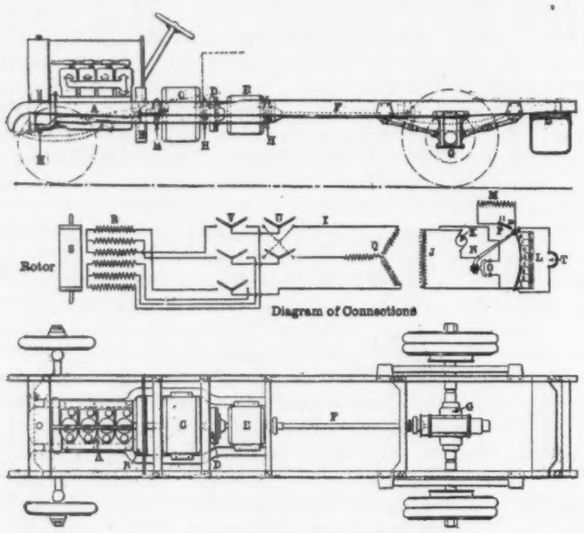


FIG. 5.—GASOLINE-ELECTRIC VEHICLE.

switches to the "stator" winding in the motor, producing a rotating field in the "stator"; the "rotor" then starts and endeavors to get into phase with the speed of the generator. Should the car be loaded it may be necessary to increase the field of the exciter, in order to get sufficient starting torque at the motor, and this is done easily by bringing the switch round to No. 9 contact; when the speed of the car has risen, direct drive is obtained by moving the switch on to No. 10 contact. This move drops the magnetic clutch winding in series with the field of the generator, weakening this field and at the same time brings the clutch over gently into contact; the last move, to No. 11 contact, which is made immediately, causes the insulated bridge-piece to short-circuit the polyphase generator field. The exciter then only supplies current to the magnetic clutch winding, which grips solid, and the direct drive on top speed, from engine to back axle, is obtained.—Lond. *Elec.*, February 1.

Electric Traction in Great Britain.—Statistical tables giving full particulars on tramways and light railways in the United Kingdom supplied from combined traction and power houses; they are 122 in number. Also tables giving complete statistical data on tramways and light railways with power houses for traction only; they are 48 in number. Finally a table is given of the 15 electric railways in operation and in progress. The total mileage of electrically-operated tramway stock has increased during the last year from 3,040 to 3,362 miles, or by 10½ per cent, as against an increase of just under 10 per cent during 1905, showing that electric tramway construction is proceeding at an almost constant rate. The column in the tables giving the size of trolley wire used is of particular interest in connection with Mr. Sheardown's recent paper before the Dublin Section of the Inst. Elec. Eng., wherein he showed that the size of trolley wire adopted had very little effect in reducing the liability of fracture. As showing the extreme variation in practice, it may be noticed that at Sheffield, where there are 258 cars, a No. 0 wire is in use, while a No. 0000 wire is used at Perth with only 12 cars, at Falkirk with 18 cars, at Chesterfield with 14 cars, at Worcester with 19 cars, and at several other towns where the traffic density does not appear to be very great. If these towns have adopted a large size of wire to guard against breakdown, it is, perhaps, doubtful if the additional cost has resulted in corresponding security. The track mileage of electric railways has increased during the year by 116 miles, as against an increase of 73 miles in 1905. There are now over 400 miles of electrically-operated railway track, and this will no doubt be considerably augmented during the present year.—*Supplement* to Lond. *Elec.*, February 1.

Electrophysics and Magnetism.

Two Insulating Materials in Series.—Benischke.—A discussion of the electric force and the perforation strength of two insulating materials in series. If two insulating materials of different dielectric constants are connected in series, the electric force in the substance with the smaller dielectric constant is larger and the electric force in the substance of the larger dielectric constant is smaller than if the whole space was filled with the same homogeneous substance. The total perforation strength is greater than if the whole space was filled with the same substance. The author then makes an application to cables with concentric layers of different dielectric constants. He finally shows that if one of two insulating materials has an appreciable conductivity, the total perforation strength is very essentially diminished, because the whole potential drop is then in the other substance so that the electric force becomes greater than if the whole space was filled with this substance.—*Elek. Zeit.*, January 31.

Alternating Current Calculations.—A note on the method of Boucherot for the mathematical treatment of alternating-current problems, first proposed by him at the International Electrical Congress in 1900. It is based on the distinction of two different kinds of power, namely, first "real power"—whenever an actual quantity of energy is produced or consumed per period—and second "compensated power"—that is, such as serves to produce magnetic fluxes or electrostatic fields, the total energy per period being zero. The application of this method is shown by two examples one being the distribution of constant current from constant-potential mains, the other the determination of the voltage drop of a transformer with an inductive load.—*L'Ind. Elec.*, January 10.

Dissipation of Electricity.—Koenigsberger.—An account of measurements of the dissipation of electricity at various places. The measurements were made with a small instrument devised by Elster and Geitel, in Freiburg, Germany, on the ocean, in Mexico and in Arizona. The values of the dissipation of electricity found in Arizona were remarkably high and are ascribed by the author either to the geological constitution of the country, containing radioactive substances, or to the photo-electric action of the very active sunlight on the iron oxides ores.—*Phys. Zeit.*, January 15.

Selenium.—Schrott.—A brief account of an experimental investigation of the allotropic modifications of selenium under the influence of heat and light. The diminution of the resistance of selenium due to light is according to the author caused by ionization, while an increase of resistance which sometimes occurs under certain conditions of the experiment with illumination may perhaps be due to photopolymerisation.—*Phys. Zeit.*, January 15.

Permanent Magnets.—A note on the question what is really permanent in a permanent magnet, whether the magnetic flux or the magnetomotive force. From recent investigations of Kempken it seems that for most applications it is sufficiently correct to assume the magnetomotive force to be constant.—*L'Ind. Elec.*, January 25.

Electrochemistry and Batteries.

Electric Smelting for the Foundry.—Moldenke.—A communication pointing out that the electric furnace should have a promising future in the foundry industry. What is wanted there, is to melt quickly, to produce very hot iron, and to punish the metal as little as possible. It is not wanted to produce

chemical changes in the mixtures if possible. The electric induction furnace seems to fill these requirements fully. In present foundry practice the crucible process is known to give the best metal but the cost is high. Now the electric furnace operation may be so conducted that all the advantages of the crucible process are retained and will give the highest class of product with the greatest ease of manipulation. The author urges the study of this line of work in contradistinction to the smelting of steel from ore.—*Electrochem. and Met. Ind.*, February.

Electric Furnaces for Iron and Steel.—KERSHAW.—In a continuation of his serial the author gives an illustrated description of the Heroult furnaces and processes The information given contains nothing new and some data are rather stale. Lond. *Elec.*, February 1.

Bleaching Liquors.—An illustrated description of an electrolytic plant by Schoop for producing hypochlorites from salt. A model of the plant was recently exhibited at the Bavarian exposition in Nuremberg. The same issue contains an abstract of a paper by Digby and Schanton on the bacterial contamination of streams and oyster beds with a description of the new Digby electrolyzer for producing hypochlorites.—*Electrochem. and Met. Ind.*, February.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—WIEN.—A very full reply to Slaby's latest article in the controversy which has been going on between Slaby and Wien in *Elek. Zeit.* on Slaby's serial on the tuning of wireless-telegraph transmitters. Wien fully maintains his former criticisms and shows clearly and in detail the mistakes made by Slaby in his theory and his calculations. In a supplementary note some misprints are corrected and a letter by Wien, containing further criticisms of Slaby, is reprinted which had been refused by *Elek. Zeit.*—*Phys. Zeit.*, January 1 and January 15.

Directed Wireless Telegraphy.—SCHMIDT.—A translation of his recent German paper on experiments with directed wireless telegraphy, especially on the effect of the height over earth and the direction of the horizontal receiving and transmitting wires. The original German paper was recently noticed in the Digest.—*Lond. Elec.*, February 1.

Miscellaneous.

Melting Points of Elements.—HARKER.—A table based on recent measurements in the (British) National Physical Laboratory, the melting points of the elements being given in degrees C., the elements being arranged according to the periodic law.—*Electrochem. and Met. Ind.*, February.

Biographical.—A biographical sketch of Prof. Charles F. Chandler of Columbia University, who has been for many years intimately connected with electrochemistry in this country.—*Electrochem. and Met. Ind.*, February.

Biographical.—A biographical sketch with portrait of Gano S. Dunn.—*Cassier's Mag.*, February.

Biographical.—A biographical sketch with portrait of Prof. A. Schuster.—Lond. *Elec. Rev.*, January 25.

BOOK REVIEW.

ELECTROLYTISCHE ALKALICHLORIDZERLEGUNG. By Dr. R. Lucion. Halle: Wilhelm Knapp. 206 pages, 181 illustrations. Price, 9 marks.

This work is Vol. XXIII of the Monographs on Applied Electrochemistry which Dr. Engelhardt so ably edits. It is concerned with an important branch of applied electrochemistry, made famous principally by the industrial achievements of Castner, Kellner and Acker, in the manufacture of caustic soda and bleaching powder.

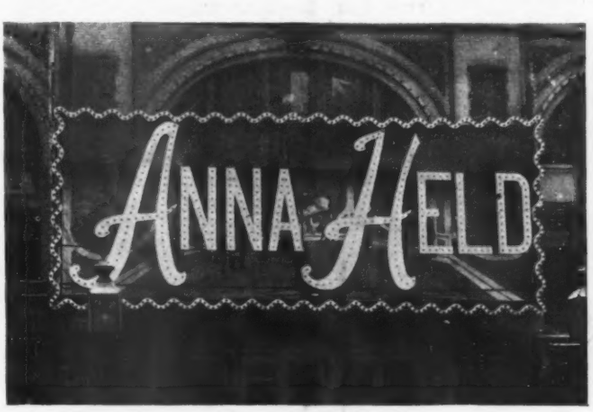
The plan of the book is to consider first the decomposition of alkali chlorides using mercury cathodes, and secondly using other molten metals as cathodes. The five pages covering the theory of such processes shows a weak grasp of the fundamental principles involved; the twenty-six pages on "practical difficulties" shows a good appreciation of the technique of the subject; the next 115 pages, forming the main body of the book, reproduce in great detail and with numerous illustrations the patent literature of fifty processes. This section lacks co-ordination and logical sequence, because it is absolutely devoid of classification, not even being in chronological order, which would have been some improvement on the alphabetical arrangement adopted. The chief weakness of the work is here exposed—it is mainly a compilation by a writer who apparently does not dare to criticize or discuss.

As it stands, the work contributes practically nothing original to our present stock of information; it is a valuable compilation useful for reference, but little adapted for systematic study of the subject. We can imagine how much better a treatise would have resulted had the author had a commanding grasp of the matter and the ability of Lorenz, for instance, to systematize, classify, discuss and criticize. However, for any one interested in the use of fluid metallic cathodes in electrolyzing alkali chlorides, there is no better book to be had—because there is no other.

A Novel Sign on Broadway.

The attempt to secure new and brilliant effects with signs on upper Broadway, New York City, has resulted in some notable and spectacular devices. Our pages have illustrated several of these from time to time, and we now show one that is certainly of a highly novel character. Beauty, they say, is in the beholder's eye, and we must leave our readers to determine how far this strikes them as beautiful; they cannot deny its weird effectiveness.

This sign is intended to advertise Anna Held, the comedienne,



A BROADWAY SIGN.

now performing at the Broadway Theatre, over which it has been placed. It consists of a frame 40 feet long and 15 feet high. In the centre is mounted the singer's name, in capital letters 12 feet high, with the smaller body capitals 8 feet high. The name contains no fewer than 350 lamps of 8 c.p.

Mounted on the edge of the huge placard are two long crawling snakes, in which are 400 lamps of 8 c.p. These alluring sinuosities are operated by an automatic switch, giving the effect of a lively chase of each other around the sign by the two snakes. The effect on bibulous gentlemen in the vicinity is said to be equal to that of a lecture by John Gough.

The words and the snakes are raised from the background 18 inches, and on the background is painted the popular rolling skating scene from the last act of "The Parisian Model." This "drop," so to speak, is illuminated by the green gleam of four strong Cooper-Hewitt mercury arc lamps set in a reflector. The green light from these lamps floods the whole

scene, while helping to throw the name and the "continuous performance" snakes into high relief.

There is no city in the world where such a sign would not make a sensation, and the Broadway Theatre does most assuredly attract the gaze of the passerby in the busiest thoroughfare of New York. The sign was designed by Mr. Mortimer Norden and built by the Electric Carriage Call Company, of 328 West Forty-first Street, New York. Regular Edison 110-volt current is used.

Snap Socket.

A new socket known as the "Security Snap" socket, which is intended to do away with the inconvenience of the screw fastened type, has recently been perfected by the General Electric Company. Such a device has been particularly needed in fixture work where it is very inconvenient to adjust an ordinary screw

FIGS. 1 AND 2.—SNAP SOCKET.

jointed socket in the husks. Moreover, the "Security Snap" socket is so constructed that it is not necessary to tip the shell to make the fastening. It may, therefore, be used in small husks as conveniently as in large.

Reference to the accompanying illustrations, Figs. 1, 2 and 3, will make the construction of the new socket clear. The security of the bayonet joint is combined with the convenience of a

FIG. 3.—SNAP SOCKET.

spring snap connection. In order to facilitate the assembly of the socket the cap and shell are marked with arrows and a star. To disunite the socket, the thumb is pressed on the star, the arrows brought into line, and a straight pull brings the socket apart. In assembling, the cap and socket are arranged with arrows in line, the shell is inserted in the cap, and turned until the socket locks.

As the shell is fastened by three bayonet joint catches, the connection is rigid, and the joint is held securely by the automatic lock.

Development of Electrical Energy at Pachuca, Mexico.

The Compania Electrica e Irrigadoro, of Pachuca, which for about six years has been supplying to the city of Pachuca electrical energy for power and lighting in that city from its Juando generating station, has now in process of construction a new plant, the Elba generating station, which has been found necessary to supply the rapidly increasing demand for power in Pachuca.

The new Elba generating station is located on the same stream as the Juando station, this stream being the waters of the drainage canal from Mexico City. At the Juando station there is in operation, approximately, 3,000 hp, comprising six 375-kw Westinghouse generators. The generators supply the energy at 440 volts, which voltage is raised to approximately 25,000 volts, 3 phase, by means of various banks of large transformers. At the Pachuca end of the transmission line, this pressure is reduced to 2,200 volts for general distribution to the various customers.

A contract with the Real del Monte mines for 5,000 hp necessitated the construction of the Elba plant, which is to be as modern in all its equipment as any plant in operation either in the Republic or elsewhere. All of the new apparatus for the Elba plant, as well as the other necessary additions to the Juando plant and the receiving station at Pachuca, will come from the works of the Westinghouse Electric & Mfg. Company, Pittsburg, Pa., whom G. & O. Braniff & Company represent in the Republic.

The plant will be equipped with four 1,540-kw alternators, generating current at 2,200 volts. These generators will be driven by Piccard, Pictet & Company's wheels, from Geneva, Switzerland. There will also be two 125-kw exciter generators in the station.

The switchboard arrangement, together with all the lightning protective apparatus and controlling switches, will be of the very latest design; the main switchboard comprising 9 panels, the controlling switches of the latest oil controlled type, operated from the main switchboard by electric contrivances.

The voltage of the generators is raised approximately 25,000 volts, by means of nine 540-kw transformers, and the energy is transmitted at 3-phase to the Juando plant, where it is connected in multiple with the Juando circuits to Pachuca. A double pole line obviates the possibility of a shut down, which might occur on either of the circuits.

At the Juando station, additional switchboard equipment is being provided for accomplishing the multiple connecting of the two generating stations, and in Pachuca a second receiving station has been built in which will be installed an 11-panel switchboard, with all the necessary distributing circuits to the various customers. Traveling cranes have also been provided in the new Elba station, a ten-ton crane over the transformers and a twenty-ton over the generators. The necessary number of transformers has been provided at this second Pachuca distributing station to handle the additional energy supplied by the Elba plant. All the switching apparatus and ten 375-kw Westinghouse transformers will be installed in the receiving sub-station for the Real del Monte people at Lorete and Dificultad. There will be 20,000 volts primary, stepping down to approximately 6,000 volts.

The line to Pachuca is about 50 kilometers distant from Juando, and another line 25 kilometers in length was extended some time ago to Dublan, at Kilometer 71, on the Central Railway, where a sub-station is located with complete equipment for supplying some 500 hp used in the cement works of the Compania de Cemento Portland, at that place. This latter company has found electricity to be so far superior to steam, not only in economy, but convenience as well, that arrangements are being made to double its present capacity, the entire plant to be operated by electric power.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The volume of business last week was well maintained. In most sections of the country the movement of merchandise has resumed normal proportions, snow blockades being removed, but tardy deliveries still cause much complaint, especially in regard to grain. Wholesale and jobbing houses report a liberal spring demand, particularly in dry goods, while at the interior there is a vigorous movement of agricultural implements and other farm supplies. A gratifying feature of many reports is the greater promptness of mercantile collections. Prices of commodities rule steady. Crop conditions are promising, on the whole. Mills and factories have so much forward business that new contracts are not taken except at full figures, and there is dissatisfaction because shipments are not more prompt. Wages have been advanced in several important concerns and there are no serious labor controversies. Railway earnings in the first week of February averaged 2.6 per cent larger than last year and foreign trade at the port of New York for the week exceeded that of the same week in 1906 by $3,898,929 as to imports, while exports increased $871,143. Recent stormy weather checks buildings, but signs of revival are noticed at the West. Iron prices for distant deliveries have eased. In the steel rail trade the feature is the sale of 50,000 tons of 80-lb. rails for export in the second half of the year. Bolivia has also taken 6,000 tons in addition to a small lot of bridge material. New business for domestic account is fair, trolley lines being the principal purchasers. Structural steel was more active. Old material is weaker. The copper market was very active. The week opened with five producers in the market with books open for June metal. By Wednesday most of the great producers had closed their books. The week ended with only one important producer of electrolytic and casting open for business under June shipments. Under the larger contracts of the week electrolytic ruled at 25c. to 25¼c., casting copper, 60 days, 25c. to 25½c. Prime lake in large tonnages was unobtainable throughout the week. Several of the minor producers of lake were able to accommodate a few old customers at home and abroad with bookings for June at 25½c. to 26c. In Europe high conductivity copper for prompt shipments is at equivalents of 25½c. to 27c. per lb. *Bradstreet's* reports 204 business failures during the week ending February 14 compared with 198 in the previous week and 208 in the corresponding week last year.

NEW YORK EDISON SYSTEM.—The *Bulletin* of the New York Edison Company for February states that at the close of 1906 the system of the New York Edison Company supplied electric current through 66,033 meters to 2,461,261 incandescent lamps, 32,320 arc lamps, 139,168 hp in motors. Additional installations in storage batteries, heating appliances and other devices brings the total installation of Manhattan Island alone to 4,762,218 equivalents of 16 candles. The net increase for the year of 1906 was 10,618 customers, 477,590 incandescent lamps, 7,978 arc lamps, 31,483 hp in electric motors and other equipment, which brought the total increase of the year to 1,007,383 16-cp equivalents. The corresponding increase for 1905 was 525,670 equivalents. During the month of December alone 1,607 additional customers, having 89,576 incandescent lamps, 1,148 arc lamps and 4,230 hp in motors and other equipment, were connected with the Edison system. The total net gain for the month was 165,008 16-cp equivalents; 24,873 contracts were signed on Manhattan Island alone for an aggregate of 2,200,000 16-cp equivalents. This result includes 1,191,281 incandescent lamps, more than 10,000 arc lamps and 63,359 hp in motors.

STATE OF COPPER.—According to the *Wall Street Journal* there are inquiries in the market for several million pounds of lake copper for delivery up to the end of June. The American Brass Company is seeking a million pounds for one of its constituent properties while one of the Western brass foundries is also endeavoring to obtain a like amount for April, May and June deliveries. A number of other large consumers need more copper for their manufacturing requirements before the end of the first half of the year, but these have been far from filled up to the present time. Twenty-five and a half cents is the top price at which business has been done for round lots of lake copper and this price was recently paid for July delivery. It is understood that the United Metals Selling Company shaded its price ⅛ cent for electrolytic beyond June, while 25¼ rules for shipment up to the end of that month.

YORKSHIRE POWER COMPANY.—The Yorkshire Electric Power Company, one of the large British territorial power schemes, has just made its annual report for 1906. The units sold for the year 1906 amount to 1,308,275, as against 335,966 for the year 1905. The demand from customers now connected to the mains amounts to 2,072 kw (2,779 hp), as against 1,402 kw (1,880 hp) on the 1st of July, 1906. Further agreements for 450 kw have been signed up to 31st of December last, and these customers are being connected up as rapidly as their own installations are ready. Negotiations are in hand with several other power users, and the officers of the company anticipate that not only will the sales of energy for 1907 show a very decided increase on those of the previous year, but that the unit costs of production will be still further reduced.

WESTINGHOUSE MOTORS.—In a brief comment on the electric situation, the *Wall Street Journal* says: "The Westinghouse Electric Company is now turning out at the rate of 3,000 motors a month, which serves to illustrate the heavy increase in the consumption of electrical apparatus. Motors are being put to new uses every day and prospects are that this year will be a record-breaker from the standpoint of output. Electric companies say that one feature that points to an increase in electrical consumption is the movement being made by great railway systems to electrify their lines in densely populated sections, particularly Chicago and New York. The majority of these railroads are now experimenting and manufacturers anticipate that it will not be long before there is a rush of orders from many of the railway systems."

DODGE & DAY.—The Royal Motor Car Company, Cleveland, Ohio, has retained Dodge & Day, of Philadelphia, as advisory engineers for the new plant it is preparing to build. The plans are well under way and work will be started immediately. Dodge & Day have also been commissioned by the Denison Manufacturing Company, South Framingham, Mass., to make a report on the power requirements of its factory. This investigation has been made necessary by the rapid growth of its business, and will determine how great an increase should be made to its present power house.

LARGE TURBINE ORDER.—The Dayton Globe Iron Works Company, of Dayton, Ohio, have just closed a large contract with the Aluminum Company of America for their plant at Massena, N. Y., which was formerly owned by the St. Lawrence River Power Company. This contract includes 24 turbines which when installed will develop 24,000 hp. The shipment will aggregate 750 tons, or in the neighborhood of 60 carloads. The work is to be shipped from July to October of this year.

IN COAL MINES.—Advices from Birmingham, Ala., state that the Tennessee Company is fitting all its coal mines with electrical haulage apparatus. It has just completed a $20,000 system at its mines at Johns, near Bessemer, and the gang has been sent on to Witwell, Tenn., where a similar system will be put in.

THE ROYAL MOTOR CAR COMPANY, Cleveland, Ohio, is providing for a power plant, in addition to the other buildings, to serve its new factory. As soon as its advisory engineers, Messrs. Dodge & Day, of Philadelphia, have decided on the nature and amount of power required, the details of the building and equipment will be determined upon.

WIRELESS EQUIPMENTS.—The Atlantic De Forest Wireless Company has equipped with its system General Delaney's yacht, *Mindora*, of the Fisheries Company, the steamer *Apache*, of the Clyde Line, and the *Cherokee* of that line.

MEETING FOREIGN REQUIREMENTS.—A report from Mr. R. F. Crist, special agent of the Department of Commerce and Labor, from Cape Town, deals with the trouble in getting orders filled satisfactorily. He says: "One case spoken of related to filling a contract to supply an engine and boiler in which several alterations deemed by the manufacturer advisable resulted in expense and loss of time to change. Another referred to the alteration of switchboards in an electrical installation. In regard to the second cause several cases have also been spoken of. One instance cited had reference to supplying hoists with electric controllers. Similar electric hoists had been furnished by a leading German electrical apparatus manufacturing house and had given particular satisfaction. An American manufacturer, however, succeeded in obtaining the award of a contract to supply a hoist and controller about July, 1905. In order to offer every advantage to this concern, and as this order promised to be one of a very large business to follow, the manufacturer was informed of the successful operation of the German apparatus, and particular emphasis laid upon the satisfaction given by the controller. Incidentally it was suggested that the manufacturer might obtain available information relating to the construction of this apparatus from the German makers. This disinterestedness brought forth the courteous response that it was unnecessary to acquire special knowledge of German electrical construction, as the American house was well acquainted with all phases of advancement in that science. The finale of this case brings me to the third cause assigned as working against an increase of American business in this field, namely, failure to deliver goods within the time promised. This apparatus was promised for delivery during January, 1906, and shortly prior to its expiration word was sent that difficulties had arisen which would necessitate a delay. Similar excuses continued until July, when it was reported that the controller constructed had proven a failure, but that orders had been placed with the German house, to which reference has been made, to ship their controllers at first opportunity. By this time it had become imperative to have the necessary controllers, and the American electrical engineer, who had proffered the advice, obtained drawings and had one constructed pending the arrival of the German product."

MESSRS. DICK, KERR & CO. (LIMITED), of London, England, are able to show that they have, during the past year, more than preserved their lead in coping with the demands of the home and colonial markets. Both in the manufacturing and contracting departments of their business they again report an exceedingly busy year; large and inclusive contracts for electric tramways, lighting and power schemes have been secured. In the permanent way department no less than 83 miles of single track has been completed, which includes some 28 miles of conduit construction carried out for the London County Council, including the much-discussed line over the Thames Embankment and Westminster Bridge. Among important contracts for permanent way and overhead construction, completed last year, may be mentioned Croydon and District, Dumbarton, South Shields, Hastings, Rochester, Burton and Ashby, Burton Corporation and Middlesex County Council, while work is now being carried on at Birmingham, Pontefract and Castleford, and for the Hertford and Middlesex County Councils. Large orders for electric tramcars have been taken, including the following: La Capital Tramways, of Buenos Ayres; Birmingham Corporation, Anglo-Argentine Tramways, Buenos Ayres and Belgrano Tramways, Johannesburg Municipal Council and Portsmouth Corporation. In spite of keen competition, the firm has booked a fair share of orders for every class of electrical machinery. It is worthy of note that particular attention has been given to high-speed machines; in fact, the turbo-alternator designed by Dick, Kerr & Co. is now in operation all over the country, orders having been taken in London, Glasgow, Leeds, Formby, Lancs, Bristol, Manchester, Blackpool, Hastings, West Ham and Sydney.

TELEPHONY IN CHICAGO.—A special dispatch from Chicago of February 14 states that the Chicago & Western Telephone Company, organized by the independent interests to take over the Illinois Tunnel Company's automatic service, will be ready to begin business in the local field March 1. It is announced that the new company has completed its engineering plant and that bids for the building work probably will be called for at once. The contracts will aggregate an expenditure of several million dollars and will require about five or six years to complete the new system. The independents have agreed among themselves to install 100,000 telephones. Three companies—to be known as the Chicago, Milwaukee & Northern Long Distance Telephone Company, the Chicago, Indiana & Eastern Long Distance Telephone Company and the Chicago, St. Louis & Western Long Distance Telephone Company—have been incorporated, each with a nominal capital of $5,000. They are controlled by the Chicago & Western Telephone Company and will form the connecting links between the independent long distance companies seeking entrance into Chicago.

SALE OF BANNER COMPANY.—According to rumors noted last week and on what is considered good authority the National Electric Lamp Company has purchased the plant and good-will of the Banner Electric Company. This was done by securing options on a majority of the stock, which has been under way for a month or more. Most of the stock was pledged and it is said that the price was such that stockholders realized a nice profit. No change will be made in the management of the works, it is said, and N. L. Norris will be retained as manager. It is said that the official force and office force will remain as they are and that the same board of directors will continue, all of them having retained some of their stock. This is following the policy of the larger company in having the business transacted through the local offices of the various companies.

LAMP MANUFACTURE.—As noted briefly by us last week, the General Electric Company has purchased the old plant of the Toledo Molding Company, at Champlain and Chestnut Streets, and will establish a factory for the manufacture of incandescent lamps. The company has been looking over the city at intervals for the past year, but did not strike the right property until a few days ago. The ground is 300 by 400 ft. in dimensions, and is occupied by a three-story building 75 by 175 ft. in size. Eventually buildings will be erected to cover the entire space. The plant will be close to that of the Libbey Glass Works, which has the contract for furnishing the General Electric with a large number of globes. The two will thus be able to work together to good advantage.

IMPERIAL PORCELAIN WORKS.—In spite of their recent fire, the Imperial Porcelain Works, Trenton, N. J., are hard at work again. They have located at once in another pottery and last week were turning out their product as usual, as though nothing had happened. Mr. F. A. Duggan says: "We are fully insured and all the dies and tools were saved with the exception of ten or twelve, so that we are enabled to begin making goods at once. Customers may rest satisfied that they need have no apprehension, but that their business will be promptly taken care of, and they may feel quite safe sending us their orders."

ELECTRICAL APPARATUS WANTED.—The *Bulletin* of the Department of Commerce and Labor, which can supply the address, has the following item: "An American consul in Asia has received a visit from a prominent official in the country in which he is located who tells him that he has received a concession for the construction of a trolley line which will cost about $365,000. American firms wishing to furnish supplies should promptly address the party. The consul adds: 'In view of this enterprise it is not too soon for American firms to take active steps concerning supplies for electric lighting here, for it is coming.'"

BAR HARBOR CONTRACT.—The Bar Harbor and Union River Power Company has awarded to Ambursen Hydraulic Construction Company the contract for constructing a reinforced concrete dam over 60 ft. high, the power house, canal, transformer house and other construction work for its power development on Union River at Ellsworth, Me. Mr. J. A. Leonard, Ellsworth, Me., is engineer and Sellers & Rippey, Philadelphia, Pa., are consulting engineers for the enterprise.

THE ELECTRIC CABLE COMPANY, 17 Battery Place, New York, has recently received large duplicate orders for Voltax, the high-potential insulating compound, from the New York Central & Hudson River Railroad Company, for use at High Bridge, where extensive electrical work is being done. Duplicate orders have been received also from the Philadelphia Electric Company, and the Public Service Corporation of New Jersey.

INCREASE AT CONCORD, MASS.—The Municipal Light Board of the town of Concord, Mass., expects within a short time to increase the capacity of the municipal plant by the addition of a three or four hundred kilowatt generator, of the turbo or gas engine type of unit. For information, Mr. A. W. Lee, manager and superintendent, should be addressed.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was strong, and although professional in character, showed a tendency to advance more in spite of a rather firmer money market. More favorable feelings about governmental interference with corporations prevailed, while the Treasury's offer to buy $25,000,000 of Government bonds had a good influence on speculative sentiment. One of the incidents of the week was rather large buying of stocks for London account, the first demonstration of that kind which has been seen for some time, although it was generally concluded that the purchasing in question was principally to cover shorts. At the close of the week the market, after an early spell of reaction, became strong and showed renewed advancing tendencies. Comparatively little business was done in electrical securities, and most of them declined in price as compared with the previous week. Brooklyn Rapid Transit was the only exception among the railways and made a net gain of 2 points. Western Union advanced a fraction, closing at 83½. There were no important features in the curb market. Prices rose and receded by turns. Following are the closing quotations of February 19:

NEW YORK

	Feb. 11	Feb. 19		Feb. 11	Feb. 19
Allis-Chalmers Co.	15¼	14	General Electric	160½	159¾
Allis-Chalmers Co. pfd.	38⅜	36	Hudson River Tel.	...	...
American Dist. Tel.	...	..	Interborough Met. Com.	35	34
American Locomotive	71¼	73¼	Interborough Met. pfd.	71	7.%
American Locomotive pfd.	111	111	Mackay Cos.	...	...
American Tel. & Cable	80	83	Mackay Cos. pfd.	...	...
American Tel & Tel.	..	...	Marconi Tel.	...	...
Brooklyn Rapid Transit	74½	73¾	Metropolitan St. Ry.	...	...
Electric Boat	32	33	N. Y. & N. J. Tel.	...	...
Electric Boat pfd.	73	83	Western Union Tel.	83	82⅝
Electric Vehicle	...	...	Westinghouse com.	150	150
Electric Vehicle pfd	...	...	Westinghouse pfd.	...	.

BOSTON

	Feb. 11	Feb. 19		Feb. 11	Feb. 19
American Tel & Tel.	128½	128¼	Mass. Elec. Ry. pfd	69	67
Cumberland Telephone	..	...	Mexican Telephone	4¼	...
Edison Elec. Illum.	225	...	New England Telephone	124	122
General Electric	..	159	Western Tel. & Tel.	...	8
Mass. Elec. Ry.	19½	19	Western Tel. & Tel. pfd.	...	77⅛

PHILADELPHIA

	Feb 11	Feb. 19		Feb. 11	Feb. 19
American Railways	50¾	..	Phila. Electric	8	...
Elec. Co. of America	10	...	Phila. Rapid Trans	21¾	...
Elec. Storage Battery	64	...	Phila. Traction	...	...
Elec. Storage Battery pfd.	..	...			

CHICAGO

	Feb. 11	Feb. 19		Feb. 11	Feb. 19
Chicago City Ry.	150	150	National Carbon	..	90
Chicago Edison	...		National Carbon pfd.	...	116¼
Chicago Subway	...	28	Union Traction	...	...
Chicago Tel. Co.	...		Union Traction pfd.	...	...
Metropolitan Elev com.	26	25			

*Ex-dividend

BROOKLYN EDISON GROWTH.—The Edison Electric Illuminating Company, of Brooklyn, has made public its report for the full calendar year 1906. It shows an increase in gross and net earnings. The income account compares as follows:

	1906.	1905.	Increase.
Gross earnings	$2,848,822	$2,542,733	$306,089
Operating expenses	1,505,768	1,351,208	154,560
Net	$1,343,054	$1,191,525	$151,529
Other income	....	8,414	*8,416
Total income	$1,343,054	$1,199,939	$143,115
Int., discount, etc.	762,478	762,067	411
†Net earnings	$580,576	$437,872	$142,704

*Decrease.

†Transferred to Kings County Electric Light & Power Company under lease agreement.

Cash on hand shows a decrease of $60,188, but the assets increased from $16,571,449 to $18,520,822. Though the total income of the Kings County Electric Light & Power Company for the year ended December 31, 1906, as stated in that company's annual report, shows a large gain over that of the previous year, the surplus exhibits a small falling off because of heavy expenses not mentioned in detail in the report. The company's receipts during the last year aggregated $580,576, an increase of $142,704; its other income amounted to $48,450, an increase of $1,692, making its total income $629,026, an increase of $144,396. Dividend disbursements involved $592,000, an increase of $192,000, making the surplus for the year $37,026, a decrease of $62,396. The total surplus aggregated $1,159,360. The company has assets of $17,427,382.

MACKAY COMPANIES REPORT.—The annual report of the Mackay Companies for the year ended January 31, 1906, shows an income from investments of $3,310,328, an increase over 1907 of $590,732. After dividends, etc., a balance was carried over of $299,829. The Mackay Companies' report states that it is the purpose to make the basis of the Mackay Companies so broad and diversified as to render impossible any fundamental impairment of the value of the preferred or common shares. The Mackay Companies is by far the largest stockholder in the American Telephone & Telegraph Company, its holdings being more than four times those of any other stockholder. The trustees state that they are again able to announce that the Mackay Companies have no debts. If the entire profits of the Commercial Cable Company and its land line system for 1906 were paid to the Mackay Companies, as might legally be done, and if the Mackay Companies used all these profits, together with its income from other investments, for the payment of dividends, the amount would be sufficient to increase very largely the present dividend on the common shares, after paying the full dividend on the preferred shares. It is said that the dividend on the common will soon be increased.

INTERBOROUGH SHORT NOTES.—The Interborough Rapid Transit Company has sold to W. A. Read & Company and Lee Higginson & Company $10,000,000 of three-year 5 per cent notes dated March 1, 1907. The price at which the notes were sold was not formally announced, but bankers who took a portion of the issue said that it was their understanding that the company had sold the notes at 95, while the offering price fixed by the purchasing bankers was 97¾. The proceeds are to be employed to pay off the company's floating debt and to provide for further construction expenses on the Brooklyn extension and for the development of trolley lines on Long Island already acquired by the Interborough. While the notes do not mature for three years, the company reserves the right to call them for payment at 101 on and after March 1, 1909, on thirty days' notice. The Interborough already has outstanding $15,000,000 of notes, maturing May 1, 1908. The present raises the total note issue of the company to $25.000,000.

DIVIDENDS.—The Chattanooga Railways Company has declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable March 1. The Kings County Electric Light & Power Company has declared the regular quarterly dividend of 2 per cent, payable March 1. The American Telegraph & Telephone Company has declared the regular quarterly dividend of 1¼ per cent on the guaranteed stock of the American Telegraph & Cable Company, payable March 1. The directors of the American Railways Company have declared the regular quarterly dividend of 1½ per cent (75 cents per share), payable March 15. The directors of the Syracuse Lighting Company have declared the regular quarterly dividend of 1¼ per cent on the preferred stock. The directors of the Harrisburg Traction Company have declared the regular semi-annual dividend of 3 per cent. The directors of the Railway & Light Securities Company have declared the regular semi-annual dividend of 3 per cent on the preferred stock.

HALL SIGNAL FINANCES.—The Hall Signal Company proposes making extensive improvements to the plant in Garwood, N. J. It is proposed to equip the factory with electrical machinery and to build a power house at an expenditure of about $1,000,000, which will be furnished by the sale of $1,000,000 of new preferred stock recently authorized by the shareholders. The company, which was reorganized for the purpose of securing a larger capital, now has $5,000,000 of 7 per cent cumulative preferred and $5,000,000 of common stock of a par value of $100 per share. Holders of the $100,000 of old 6 per cent preferred stock have received in exchange new preferred stock on the basis of share for share, together with a bonus of $20 per share. Of the total $5,000,000 of new preferred stock, $1,000,000 will soon be sold at par to pay for the contemplated improvements in the Garwood plant.

AMERICAN UNION TELEPHONE.—It is announced that the American Union Telephone Company, which represents all the merged independent telephone companies of Pennsylvania, Southern New York, Maryland, Northern Virginia and West Virginia, will expend $2,685,000 for improvements throughout the system. The company covers about one-third of the territory of the United States, containing more than half of the population of the country. Included in the new company is the Union Telephone Company. The company was incorporated last May, with principal offices in Harrisburg.

N. Y. & N. J. TELEPHONE.—The annual report of the New York & New Jersey Telephone Company for the year ended December 31, 1906, shows gross earnings of $7,447,147, as against $6,217,268 in 1905; expenses, $5,659,654, as against $4,708,654; net earnings, $1,787,453, as against $1,508,654, and surplus of $428,067, as compared with $411,868. The balance of earnings over charges was $1,700,864, equal to 8.9 per cent on $19,081,000 capital stock. President U. N. Bethell says that as a result of frequent and systematic reductions the average earnings per station have decreased 50 per cent in the last ten years. Although a little more than one-half of the decrease was made in the first five years, the average has declined every year and the decline has been fairly uniform. During the same years there has been an increase from 14,333 to 131,442 in the number of stations. The percentage of gain was greater in 1905 and 1906 than in any previous two years, amounting to 63.64 per cent. There were 131,442 stations in service at the end of 1906, as compared with 80,324 at the close of 1904. Mr. Bethell sets forth the company's financial condition as follows: "From the issue of stock at par the treasury received during 1900, from the 1905 offering, $632,225, and from the 1906 offering, $1,719,100, a total of $2,351,325. The 1906 offering was limited to 10 per cent of the then outstanding stock. The proceeds from these sales being insufficient to provide for the large additions made to the property and plant during the year, the additional funds required were raised by loans upon the company's notes. The outstanding bills payable at the close of the year amounted to $2,050,000. To pay these loans and provide for 1907 construction, the board of directors in December, 1906, authorized an offer to stockholders of new stock at par to the amount of 33 1/3 per cent of the then outstanding stock, or $6,310,166."

TELEPHONY IN MEMPHIS.—The Memphis Telephone Company, independent, which has been competing with the Cumberland Telephone &. Telegraph Company for several years on local and long-distance business, has announced for sale $200,000 of capital stock and $400,000 of 5 per cent bonds for the purpose of increasing its facilities. The company has an authorized capital stock of $600,000, of which only $400,000 is outstanding, and it is authorized to issue $3,000,000 worth of bonds and, with this latest issue, has outstanding only $1,000,000, thus leaving $2,000,000 in reserve for future requirements. Local capitalists have secured the controlling interest in the company on condition that three-fifths of the stock be deposited with the Union & Planters' Bank & Trust Company for 10 years; that all the officers and a majority of the directors shall be Memphis men, and that there shall be no effort to consolidate with or sell out to the Cumberland people within a specified time. The company is said to have been earning and paying 5 per cent on its outstanding bonds ever since it began operations, and it is also said that 6 per cent has been earned on the capital stock, but that this has been applied to improvements instead of being paid in the form of dividends. The company now has about 3,500 stations.

MICHIGAN TELEPHONE.—The report for the year ended November 30, 1906, made by the Michigan State Telephone Company, shows a gain in its gross earnings amounting to $327,797, but a loss of $16,658 in its net profits. The operating expenses included $770,225 of maintenance charges, which is at least $100,000 more than the maintenance charges for the previous year. The company's income account for the last fiscal year, with that for the previous year, follows:

	Year ended Nov. 30, 1906.	Year ended Dec. 31, 1905.
Gross	$2,621,349	$2,293,552
Expenses	1,964,678	1,620,223
Net	$656,671	$673,329

The company had 91,547 stations, or 14,500 more than at the close of the 1905 fiscal year. Incluidng its sub-licenses, the company had in all a total of 116,221 subscribers. The amount of first mortgage bonds now outstanding is $6,281,000, which includes a new issue of $384,000 authorized to pay for 75 per cent of the cash cost of recent additions to the property.

TELEGRAPH AND TELEPHONE.—A personal friend of the late Mr. John W. Mackay, in Boston, reports as follows: "When living, Mr. Mackay frequently talked to his friends of the advantages that would accrue to have the telegraph, telephone and cable service under one management. The recent report of the Postal system (the Mackay companies) would indicate that the present management of the system, headed by Mr. Mackay's son, Clarence H. Mackay, was carrying out a policy laid down by the senior Mackay in accumulating stock of the American Telephone & Telegraph Company and the subsidiary companies of the American Company's system. Triplicate offices are now maintained for electrical transmission of intelligence as well as triplicate systems of poles, wires, etc., throughout the United States and Canada. A consolidation of the telegraph, telephone and cable service would save millions annually in operations and extensions, as no new money would be required for some years for poles and wires after a consolidation had been affected. And the service of a combined system would be supreme."

SOUTHERN NEW ENGLAND TELEPHONE.—The annual report of the Southern New England Telephone Company, operating the Bell telephone system in Connecticut, shows as follows for the year ended December 31:

	1906.	1905.
Exchange services	$1,323,990	$1,135,858
Toll service	449.571	375,243
Priv. line and miscellaneous	55,582	52,509
Total gross	$1,829,143	$1,563,610
Expenses—		
General	$263,608	$240,171
Operating	387,458	312,592
Maintenance	651,346	574,109
Rental and royalty	77,318	64,929
Interest	87,738	48,819
Miscellaneous	10,160	15,430
Total expenses	$1,477,628	$1,256,110
Net earnings	351,515	307,500
Dividends	307,500	277,500
Surplus	$44,015	$30,000

STONE & WEBSTER MANAGEMENT.—Stone & Webster, of Boston, have issued their 1907 manual showing the total earnings and expenses of thirty electric railway and lighting properties under their management for the year 1906. The combined statement of the thirty companies follows:

	1906.
Gross earnings	$13,410,779
Operating expenses	8,361,897
Net earnings	5,048,882
Interest charges	2,035,951
Balance	3,012,931
Dividends paid	1,196,798
Balance	$1,816,133

The combined capitalization of these companies is:

Bonds issued	$47,559,000
Stock issued	57,690,200

KANSAS CITY EARNINGS.—The Kansas City Railway & Light Company reports for December and seven months ended December 31, as follows:

	1906.	1905.
December gross	$499,631	$447,245
Expenses	244,102	245,465
December net	$255,529	$201,780
Charges and taxes	147,891	.....
December surplus	$107,638	.....
Seven months gross	$3,372,620	$3,038,322
Expenses	1,658,721	1,713,640
Seven months net	$1,713,899	$1,324,682
Charges and taxes	$1,017 614	.....

WILKESBARRE EARNINGS.—The Wilkesbarre Gas & Electric Company has issued its annual report for the year ended December 31, 1906. The income account compares as follows:

	1906.	1905.	
Gross	$316,614	$297,595	Inc. $19.019
Expenses	172,878	141,443	Inc. 31,435
Net	143,736	156,152	Dec. 12,416
Charges	105,361	109,486	Dec. 4,125
Surplus	$38,375	$46,666	Dec. $8,291

BIRMINGHAM (ALA.) GROWTH.—The report of the Birmingham Railway, Light & Power Company, which operates the car lines in Birmingham and vicinity, for 1906, shows a total of 30,398,342 passengers hauled. The company will spend another $1,600,000 in betterments this year. Engineers are now preparing plans for a large new power house just north of the city.

GENERAL NEWS.

Construction News.

ATMORE, ALA.—A company has been formed to operate an electric light plant and ice factory at this place. The company will have a capital stock of $12,000 and has purchased the Atmore Mill & Gin Company system. The company will install a new 60 or 70-hp boiler and engine, and a five-ton ice plant. The electric plant will have a capacity of from 1,000 to 1,200 lamps. The officers are M. M. Brooks, president; W. W. Lowery, vice-president; W. S. Brantley, secretary and general manager.

BIRMINGHAM, ALA.—The water powers on Locust Fork of the Warrior River near Birmingham have been purchased and options secured on about 12 miles of the Warrior River, with a view of developing it and furnishing Birmingham with 25,000 hp and with water by a gravity canal for industrial and domestic purposes. Surveys have already been made. For further information address E. J. McCrossin, Woodward Building, Birmingham, and John L. Ray, president of the Albertville Realty Company, Albertville.

DECATUR, ALA.—The capitalization of the North Alabama Traction Company is to be increased from $150,000 to $300,000 at once. This increase is for the purpose of extensions and improvements. A. C. Hartshorne, of Freehold, N. J., is president.

JUNEAU, ALASKA.—The City Council is said to have practically granted a 50-year franchise to the Salmon Creek Light & Water Company.

FRESNO, CAL.—The San Joaquin Light & Power Company has announced a reduction in its rates for electricity beginning with Feb. 1. The rate up to 75 kw will be reduced from 10 cents to nine cents; from 76 to 100 kw, from 10 to 8½ cents; from 101 to 150 kw, from 10 to 8 cents; from 150 upward, from 10 to 7½ cents.

OAKLAND, CAL.—The Southern Pacific Company has purchased an entire block lying west of Fruitvale Avenue as a site for the new power house and car barns which the company will erect in connection with the establishment of an electric railway to supersede the steam roads between this city and Alameda. The company proposes to erect a large power plant at this point for the generation of electricity for the entire new system, at a cost of $500,000.

PASADENA, CAL.—Bids will be received until Feb. 26 by the Mayor and City Council, to furnish a 300-kw steam engine or steam turbine electric lighting plant, completely erected ready for operation within a building and on foundations to be furnished by the city. Bids will also be received same time and place for furnishing and delivering f. o. b. cars, Pasadena, 300 cutter inner rope mast arms with double-braced strain arms, extra center rod and triple insulation lamp hanger arm; 100 Cutter, avenue incandescent street hoods, each 6 ft. long, fitted, ornamental brace arm and Edison bracket; 100 6 and 6-10 ampere alternating-current series enclosed arc lamps fitted with enamel steel reflectors, and clear outer and inner globes, designed for street lighting; also for constructing in the rear of the electric light plant on Lot 13, G. E. Smith subdivision, a cement oil tank and water reservoir; said reservoir shall be 59 ft. long, 36 ft. wide and 11 ft. deep, outside bottom measurements. Herman Dyer is city clerk.

REDDING, CAL.—The Pacific Power Company has decided to construct a small plant immediately in the bottom of Battle Creek to expedite the completion of the larger installation. The small plant is to be so constructed as to be a part of the large plant. The vacancy caused by the resignation of W. H. Winters has been filled by the election of J. N. Farlon, of Battle Creek, who will also be treasurer.

SACRAMENTO, CAL.—A new electric railway to be known as the Sacramento & Vallejo Railroad to operate a line between the two cities in the title, is soon to be built by San Francisco capitalists. The capital stock of the company is $1,000,000 and the directors are Lucian W. Knight, of Sausalito, Benjamin Pringle, of Sausalito, and William G. Barr, of San Francisco.

SAN DIEGO, CAL.—The National City & Otay Railway, San Diego, which is now a steam railroad, is being equipped for electrical operation between San Diego and Chula Vista, a distance of approximately 10 miles.

SAN FRANCISCO, CAL.—The Pacific Telephone & Telegraph Company is about to take control of the Southern Nevada Telephone & Telegraph Company, which circles the mining camps of Southern Nevada. At present the Pacific Telegraph & Telephone Company has no communication with the mining districts, but a direct wire will be immediately installed to Goldfield.

SAN FRANCISCO, CAL.—Bids will be received until Feb. 26 for the installation of electrical work at the U. S. Immigration Station on Angel Island. Particulars can be obtained upon application to the office of Walter J. Mathews, 969 Broadway, Oakland.

SANTA BARBARA, CAL.—The Sunset Telephone Company is contemplating an expenditure of $40,000 in improving the local service.

STOCKTON, CAL.—The Stockton Electric Railway Company is preparing to construct an auxiliary plant which will increase the power capacity of the system 660 hp. The additional machinery is being placed in the power house of the Stockton Gas & Electric Company, which handles the electric energy for the company.

STOCKTON, CAL.—Estimates have been made for the installation of an electric generator at the dam of the Nameless mine and for the transmission of electricity from the mines to a rock crusher plant at Jasper Point, on the Yosemite Valley Railroad. The machine will furnish about 250 hp, of which 150 will be used by the rock crushing plant.

AULT, COL.—Walter J. Farr, owner of the Eaton electric light plant, has made application to the Town Board for an electric lighting franchise.

COLORADO SPRINGS, COL.—The Cunnajuta Power & Electric Company of this city will construct at once a second power plant to cost upwards of $1,000,000 in the State of Michoacan, Mex. Work on the construction of the plant will begin in March.

LONGMONT, COL.—J. P. Smith, of Longmont, writes that he proposes constructing a power and heating plant here, at a cost of $100,000.

HARTFORD, CONN.—At the annual meeting of the stockholders of the Hartford Electric Light Company, held Feb. 12, it was voted to increase the capital from $1,800,000 to $2,100,000, part of which will be expended for new construction work.

NEW BRITAIN, CONN.—The Stanley Works Company has made application to the State Legislature for authority to generate electricity in the town of Kent and to transmit it to the company's plant in this city. The company has preliminary plans for the development of an extensive power plant, from which electricity will be transmitted over high-tension wires a distance of about 40 miles. Another provision of the resolution authorizes the company to increase its capital stock from $1,500,000 to $3,000,000.

WALLINGFORD, CONN.—The New York, New Haven & Hartford Railroad Company is planning to erect a sub-station near Dry Brook switch for the purpose of increasing the power service for its electric railway over the suburban line from New Haven to Wallingford. Electric energy for the station will be furnished from the company's power plant at Berlin. The machinery for the sub-station has been ordered from the General Electric Company, and the contract for the construction of the building has been placed with C. W. Murdock, of New Haven.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Mar. 5 to furnish at the navy yards, etc., Portsmouth, N. H., Boston, Mass., Newport, R. I., New York, N. Y., League Island, Pa., Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 417, arc lamps, etc. Schedule 418, grapnels, crucible steel wire, etc. Schedule 419, incandescent lamps, cable, silent chain drive, electric drills, pneumatic drills, etc. Schedule 420, electrical wire, incandescent lamps, electrical supplies, steering engine, etc. Schedule 421, bronze billets, sheet copper, copper pipe, etc. Schedule 422, bronze rod, sheet brass, copper rod, copper tubing, etc. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster General, U. S. N.

DECATUR, GA.—The Decatur Electric Light, Power & Water Company is making arrangements to take electricity from the North Georgia Electric Company within 90 days to operate its entire system. A. B. Houston is superintendent.

ROME, GA.—At a recent meeting of the Merchants' and Manufacturers' Association, Benjamin Watts submitted a proposition of building an electric railway which would extend from Rome to Cedartown, Cave Springs, Lindale, Etna and other nearby towns, embracing a circuit of 50 miles. The road will cost about $500,000.

VIDALIA, GA.—Bids will be received by S. B. Meadows, Mayor, for $23,000 water works and electric light bonds.

WAYCROSS, GA.—At a meeting of the City Council held Feb. 9, the Waycross Electric Light & Power Company offered to sell its plant and business to the city for $75,000.

SILVER CITY, IDAHO.—The Trade Dollar Consolidated Mining Company is now adding four 66-inch American wheels and two 700-kw generators to its plant. Fred Irwin is manager.

ABINGTON, ILL.—W. A. Thomas, manager of the Abingdon Electric Company, writes that the company is now installing a complete new outfit, including everything except boilers, and will in all probability start an alternating-current day service within the next three months largely for power business, which the company will make an effort to develop.

ALTON, ILL.—The Alton Gas & Electric Company has decided to rebuild its electric lighting system in Alton.

ATWOOD, ILL.—The capital stock of the Atwood Telephone Company has been increased from $9,000 to $12,000.

BELLEVILLE, ILL.—Notice has been filed of the change in name of the Belleville Gas & Electric Company, to the St. Clair County Gas Company, and of an increase in capital stock from $350,000 to $3,500,000.

CHICAGO, ILL.—Wm. Carroll, City Engineer, writes that the General Electric Company has secured the contract for motors in the municipal electric light station, for $47,146.

EAST ST. LOUIS, ILL.—At a joint meeting of the directors of the Belleville Gas & Electric Company and the East St. Louis Gas Light Company, held Feb. 15, a consolidation of the companies was affected. O. H. Quackenbush was made general manager of the new concern. He was formerly in charge of the East St. Louis plant.

LADD, ILL.—It is reported that the City Council has decided to install an electric light plant.

MARISSA, ILL.—J. R. Creighton, manager of the municipal electric light plant, writes that a meter system will probably be installed and that 50 arc lamps or 100 series incandescent lamps will be added to the street lighting system, and that the installation of a 300-hp engine and a 125-kw alternator is contemplated this coming summer. A cold storage plant of 10-ton capacity is now being added to the plant.

MOUNT CARMEL, ILL.—The capital stock of the Mount Carmel Gas & Electric Company is to be increased from $15,000 to $25,000.

MURPHYSBORO, ILL.—The City Councils of Carbondale and Murphysboro have granted the Southern Illinois Transit Company franchises to construct and operate an electric railway for a period of 30 years. The company proposes to build an electric line from Murphysboro to Johnson City.

PARIS, ILL.—The Terre Haute & Western Railway Company has applied to the City Council for a franchise to operate a street car line in this city.

PEORIA, ILL.—The Peoria Electric Light Company contemplates extending its transmission lines to Washington and Metamora.

SPRINGFIELD, ILL.—The Springfield, Wilmington & Cincinnati Railway Company has increased its capital stock from $3,000,000 to $4,000.000.

WASHINGTON, ILL.—The Eagle Electric Works will change the present street lighting system to alternating-current series street lighting. Charles Charvat is manager.

CAYUGA, IND.—The Cayuga Electric Company is contemplating the extension of its lines to Eugene, Kingman and Newport, and the installation of an ice plant. J. W. Shaw is manager.

MATTHEWS, IND.—The Matthews Electric Steel Casting plant has been purchased by a Chicago company and will be operated under the name of the Armor Steel & Foundry Company. Considerable new electrical machinery will be added and other improvements made.

MICHIGAN CITY, IND.—Clarence H. Geist, of Philadelphia, has purchased the Michigan City Light & Power Company's plant for $150,000.

MT. VERNON, IND.—The Mt. Vernon Electric Company is being formed for the purpose of furnishing electricity for lighting Coseyville, Cynthia and Waynesburg. The company expects to establish an electric light plant at Mt. Vernon.

PLYMOUTH, IND.—The owners of the Plymouth electric light plant are now contemplating the installation of a day service. C. D. Snoeberger.

SOUTH BEND, IND.—The Dutrich-Murdock syndicate, which recently purchased the property of the Northern Railway Company, announce that a new power house will be built at once near South Bend.

ATLANTIC, IA.—The citizens are considering the installation of a 75-kw outfit for day service and adding 50-hp alternating current to motor load to the municipal electric lighting plant. John J. Rapp is manager.

CLINTON, IA.—The Clinton Gas Light & Coke Company is contemplating the installation of an additional 800-hp engine and generator; also boilers and condensers, pumps, etc., and new gas apparatus. Thomas Crawford is manager.

DAVENPORT, IA.—The City Council has passed an ordinance granting to the Central Union Telephone Company a new 25-year franchise. The ordinance provides that the company shall place its wires underground in the fire limits of the city.

DUNCOMBE, IA.—M. L. Harkins, City Clerk, writes that the citizens will in the Spring vote on issuing bonds for the construction of an electric light plant.

FARRAGUT, IA.—E. E. Odell, City Clerk, writes that there is some talk of voting for an electric light plant at the coming election.

FORT DODGE, IA.—By a special agreement entered into between the City Council and the Fort Dodge Light & Power Company, a truce has been arranged whereby the Council will defer action toward the cancelling of the franchise of the company in this city for electricity and gas service. The poor service rendered by the company and the fact that the consumers have been paying the highest rate in the State caused the Council to take steps to revoke the franchise.

FORT DODGE, IA.—It is reported that the Fort Dodge, Des Moines & Southeastern Railway Company will apply to the City Council for permission to furnish electricity for lighting and power in Fort Dodge. This follows the revoking of the exclusive franchise.

GUTTENBERG, IA.—The plant of the Home Electric Company is now being duplicated with Westinghouse apparatus. Z. G. Houck is president.

IOWA CITY, IA.—The Iowa City, Kalona & Washington Electric Interurban Railway Company is planning to construct an electric railway to Washington and Muscatine.

LAKE CITY, IA.—Otto E. Brownell, manager of the Lake City Electric Company, writes that the company expects soon to install a 35-kw, 220-volt, direct-current generator and a 50-hp engine in its plant.

MARENGO, IA.—The Marengo Electric Light & Power Company is contemplating adding a new engine and dynamo in its plant and reducing the frequency to 60 cycles. V. T. Matthews is manager.

NEW HAMPTON, IA.—F. B. Strike, City Clerk, writes that the citizens voted Feb. 5 to issue $18,000 in bonds for the construction of water works and an electric light plant.

NEWTON, IA.—C. O. O'Leary, chief engineer of the municipal electric light plant, writes that the installation of a 400-hp engine and a generator of 300-kw capacity is being considered for the municipal electric light plant. The City Council recently decided to expend about $15,000 in new equipment for the plant.

PELLA, IA.—An election will be held on March 5 to vote on issuing bonds for water works and an electric light plant.

SIOUX CITY, IA.—E. J. Stason, secretary of the Municipal League, has requested the City Council to consider the erection of a municipal lighting plant.

SIOUX CITY, IA.—The Sioux City Gas & Electric Company is contemplating improvements to its electric plant, which will cost about $100,000, and will also place its wires underground in the fire limits of the city, which will involve an expenditure of $100,000.

TAMA, IA.—W. E. Fowler is chairman Lighting Committee, which will have charge of constructing the electric light plant, for which the citizens on Feb. 4 voted to issue $10,000 in bonds. H. J. Ferguson is City Clerk.

HERRINGTON, KAN.—The City Council has taken over the electric light plant and also the water plant of the Herrington Light, Power & Water Company.

HOLTON, KAN.—Sealed proposals will be received at the office of the City Clerk, until March 5, for furnishing all labor, material, equipment and installing a combined electric light and water works plant, with distributing system, for the city of Holton. Plans and specifications are on file at the office of the City Clerk and also at the office of the consulting engineers, the W. K. Palmer Company, Kansas City, Mo.

CUMBERLAND FALLS, KY.—A syndicate composed of William F. Cox, of New York, N. Y.; S. S. Wetmore, of Philadelphia, Pa.; S. L. Merchant, of Boston, Mass., and others, are contemplating the construction of a hydro-electric plant on the Cumberland River at Cumberland Falls, in Kentucky, about 25 miles from Williamsburg, at a cost of about $3,500,000. Arthur Giesler, electrical engineer, 29 Broadway, New York, N. Y., has been engaged to prepare plans for the plant. The first installation of the plant will be not less than 20.000 hp. It is expected to have the plant in operation within 18 months, and the equipment of the power station will include four or five turbines and generators with a capacity of 5,000 hp each.

FULTON, KY.—W. W. Meadows has applied to the City Council for an electric light franchise.

HENDERSON, KY.—The Henderson City Railway was sold at auction on Feb. 18 by order of Judge J. W. Henson, of the Henderson County Circuit Court. No bids for less than $80,000 would be considered in the sale, that amount being two-thirds of the appraised value.

HENDERSON, KY.—C. W. McCormick, of this city, appeared before the City Council on Feb. 5 as a representative of outside capital and offered to buy the municipal lighting plant for $75,000 cash. H. W. Burgey, of Cincinnati, Ohio, also appeared before the Council and offered to lease the light plant for twenty years and pay annually to the city 10 per cent of the net earnings. Both propositions were referred to a committee.

HOPKINSVILLE, KY.—The stockholders of the Cumberland Telephone & Telegraph Company have authorized an increase in capital stock from $20,000,000 to $30,000,000, to meet the demands of the growth of business and to acquire new properties.

LOUISVILLE, KY.—G. J. Lampton, a local traction promoter, announces that the Central Kentucky Traction Railroad Company will be formally incorporated March 1, and that as soon after as the weather will permit the building of the line from Elizabethtown to West Point will commence. The line will extend a distance of 27½ miles and will cost $300,000. The company will be organized with a capital stock of $60,000. Mr. Lampton also states that the line will be extended from Elizabethtown to Bowling Green.

LOUISVILLE, KY.—Lewis S. Streng is preparing plans for the proposed power plant for the Kentucky Electric Company. The plant will have a capacity of 3,000 kw.

SPRINGFIELD, KY.—The Springfield Water & Electric Light Company is now placing in its plant a direct-current, three-wire generator made by James Clark, Jr., & Company, of Louisville, and a Skinner engine. H. B. McElroy is manager.

BRUNSWICK, ME.—A syndicate headed by Charles Sumner Cook, of Portland, has purchased the water privilege and property of the An-

droscoggin Pulp Company in this place and intends to erect an electric power plant in the spring.

MIDLAND, MD.—The Midland Electric Light Company has been incorporated by William B. Phillips, A. A. Davis, Edward R. Grant and others. The company is capitalized at $5,000. Arrangements have been made with the Consolidated Coal Company to supply electricity for operating the system, which will have a capacity of 2,500 lamps. The Consolidated Coal Company will install a large dynamo in its Ocean mine power house for this purpose.

LEE, MASS.—The Lee Electric Light Company is preparing to increase the capacity of its plant and has placed an order for a 250-hp engine and dynamo, which will be placed in the steam plant in this place.

NORTH ADAMS, MASS.—A petition has been presented in the State Legislature signed by Sanborn G. Tenney, of Williamstown, and others for an act to authorize the Deerfield River Power Company, a Vermont corporation, to build dams and other structures in this state. Saxon Bowen, of Readsboro, Vt., is one of the men interested in the scheme, which includes the damming of the Deerfield River for the purpose of furnishing water power. It is understood that Mr. Bowen is one of those interested in the original proposition to dam the Deerfield River, seven miles up the river from Hoosac Tunnel station and transmit electrical power over the mountain to this city.

PALMER, MASS.—The Central Massachusetts Electric Light Company has passed into the hands of the New York, New Haven & Hartford Railroad Company. A controlling interest has been purchased by the New England Security & Investment Company, of Boston.

SALISBURY, MASS.—The Haverhill & Amesbury Street Railway Company is planning to erect a sub-station on Ring's Island, and has applied to the Selectmen of Salisbury for permission to erect poles and string wires through the town for its transmission lines. The company contemplate an expenditure of $30,000 in improvements and changes to its system in this place.

SPRINGFIELD, MASS.—The Springfield Street Railway Company is contemplating increasing the capacity of its plant and will probably add at least one generator of 2,000 kw capacity to its plant in the near future. Henry C. Page is manager of the company.

WESTFIELD, MASS.—The demand for electricity for power purposes is increasing and it is expected that before another year the municipal electric and power plant will be on a paying basis. Two motors, one of 10-hp and the other of 5-hp, are to be installed at H. M. Vandeusen whip works. Beckwith Brothers & Company expect to operate their new factory by electricity.

CRYSTAL, MICH.—Extensive improvements will be made to the municipal electric light and water works plant, which will include the installation of a 250-kw dynamo, 1,000-gallon pump and a turbine of 600 hp. Q. Stephany is superintendent.

ALPENA, MICH.—The Alpena Electric Light Company is building a modern station and will abandon the use of 125 cycles entirely. The company will use the three-phase system. William E. Hazell is manager.

ESCANABA, MICH.—The City Council has decided to engage an expert electrical engineer to investigate the condition of the electric plant and report on the necessary improvements.

GRAND RAPIDS, MICH.—The Grand Rapids Electric Company has applied to the Common Council for a franchise asking for the right of way for tracks through the city, which is to be a part of its projected interurban system. It is to begin at Alpena and run to Camden and thence to the state of Ohio. J. W. Boynton is president.

HUBBARDSTON, MICH.—The Hubbardston Electric Light & Power Company is considering putting a small dynamo in its plant to operate the arc lamps. There are eight direct-current, 240-volt enclosed arc lamps. The company would consider the purchase of a second-hand machine if it were in good condition. Henry Slocum is manager.

MANISTEE, MICH.—The Manistee Gas & Electric Company is planning several miles of extension to its lines this summer. Frank J. Huntoon is manager.

MENOMINEE, MICH.—William Holmes, of Menominee, is interested in the construction of a dam at Grand Rapids for electrical purposes.

MT. CLEMENS, MICH.—The St. Clair Edison Company on Feb. 6 assumed the management of the Mt. Clemens Electric Company. The business will be continued under the old name at present. The officers of the Mt. Clemens Electric Company are Hoyt Port, president; Alex. Dow, vice-president; Alex. Jacobi, secretary; E. F. Phillips, manager, and J. C. Hostger, superintendent.

OWOSSO, MICH.—Negotiations for the purchase of the Owosso & Corunna Electric Company's plant by the recently incorporated Lansing, Owosso & Saginaw interurban line are in progress.

BOVEY, MINN.—The village of Bovey has called for bids for the erection of an electric light plant.

CROOKSTON, MINN.—Edw. Peterson, treasurer of the Crookston Water Works, Power & Light Company, writes that J. W. Rickey, of Minneapolis, has prepared plans and estimates for a power plant and dam, but the company is not yet ready to let contract.

DAWSON, MINN.—Bids will be received until March 11 by the Village Council (James O'Hara, president) for $28,000 in bonds to be issued for the purpose of establishing waterworks and an electric light plant.

DULUTH, MINN.—The West Duluth Commercial Club is taking active steps toward securing a street car line to Proctor, and has appointed a committee, consisting of W. B. Getchell, J. B. Flack and William Langslow, to confer with a committee from the Proctor Council.

MARSHALL, MINN.—Two high-pressure boilers have recently been installed in the municipal electric light plant and specifications are now being made for a 150-kw direct-connected unit, three-phase, alternating current, with switchboard and all modern instruments, series alternating-current arc lamps, condenser and also a 35-kw belted generator same type as above. E. Simmons is superintendent.

PARKSTON, MINN.—William Moeller has been granted a franchise by the Council to establish and operate a gas and electric lighting system in this place.

HATTIESBURG, MISS.—Bids will be received until March 6 by the Hattiesburg Traction Company, of which H. A. Camp is president, for furnishing material and constructing an electric railway. Edward J. O. Bierne, Atlanta, Ga., is the engineer.

ELDORADO SPRINGS, MO.—The Eldorado Springs Electric Company will install a boiler in its plant and possibly change the alternating-current dynamo and engine. F. W. Hiatt is manager.

KANSAS CITY, MO.—William F. Lyons, president of the Central Ice Company, has applied to the City Council for a thirty-year franchise for an electric light, heat and power plant.

ST. LOUIS, MO.—Herbert A. Vreoman has applied to the City Council for a 50-year franchise to furnish electricity for lighting the streets of the city and to the public in general. The construction of the plant is to be done under the supervision of the Board of Public Improvements and the Street Commissioner, and at the end of twenty years the city is to have the privilege of purchasing the plant.

MISSOULA, MONT.—C. A. Jakways, of Ovanda, is promoting a movement to build an electric railway to Great Falls.

BLAIR, NEB.—E. V. Capps, manager of the Blair electric light plant, writes that the plant will soon be changed to 60-cycles, three-phase system if a contract can be made with the mill for power.

FRIEND, NEB.—A. H. Frantz, city clerk, writes that the citizens voted Feb. 8 to issue $8,000 in bonds for the construction of an electric light plant.

ORD, NEB.—F. J. Bell, A. P. Jensen and C. E. Detweiler are among the incorporators of the Ord Electric Light & Power Company, recently formed here, to construct an electric light plant. This company has not yet received a franchise. There is another plant already in operation here.

TECUMSEH, NEB.—The City Council has called a special election to be held on March 5 for the purpose of voting on the proposition of issuing $12,750 in bonds for the purpose of establishing a municipal electric lighting plant.

YORK, NEB.—The York Gas & Electric Company is contemplating adding 250 hp to its plant during the coming season and changing the system from direct to alternating current. G. W. Shreck is manager.

MANCHESTER, N. H.—The Derry & Goff Falls Electric Railway Company has been granted the right of incorporation by the State Supreme Court. The new road will be about eight miles long. The incorporators are Roswell Annis and James Cavanaugh, of Manchester.

NEWARK, N. J.—The Council on Feb. 8 authorized the special lighting committee, of which Alderman McGovan is chairman, to employ an electrical expert to prepare plans and specifications and supervise the preliminary work in connection with the construction of an independent lighting plant for the new city hall.

SECAUCUS, N. J.—Bids will be received until Feb. 25 by the Board of Chosen Freeholders, at Jersey City, for constructing and installing an electric lighting system in the new county almshouse at the County Farm, Secaucus. Walter O'Mara is clerk of board.

LAS VEGAS, N. M.—It is promised the people of Mogollon and Cooney mining camps that the electric power project planned for the district will be constructed and in operation by the end of the year. Further details indicate that the electric plant will furnish 1,000 hp when completed. Eastern capitalists are said to be behind the scheme, and propose to expend $200,000 on the plant and transmission line.

ALBANY, N. Y.—The Economic Power & Construction Company, of Albany, has filed a $250,000 mortgage in the County Clerk's office, and it is stated, intends to construct plants in Buffalo, Rochester, Syracuse, Utica, Schenectady, Troy, Albany, Yonkers and New York City.

BROOKLYN, N. Y.—Bids will be received until Feb. 25 by C. B. J. Snyder, superintendent school buildings, New York City, for installing electric equipment in new school 50, Borough of Brooklyn; also in new school 68, Evergreen, Borough of Queens.

CANISTEO, N. Y.—It is reported that the directors of the Steuben Traction Company have under consideration an issue of $500,000 in bonds for the purpose of building the road.

DUNKIRK, N. Y.—It is reported that the Chautauqua Traction Company, or parties connected with this company, including A. N. Broadhead,

are interested in the construction of an electric railway from Jamestown to Dunkirk. It is understood that the new line will be about 25 miles long.

LYONS, N. Y.—The Business Men's Association of this place has appointed a committee to take charge and push the scheme of constructing the Lyons and Sodus electric railway.

MEDINA, N. Y.—The Board of Trustees have awarded a five-year contract to the A. L. Swett Electric Light & Power Company for lighting the streets of the town.

NEW YORK, N. Y.—C. F. Hoppe, chief architect of the New York Edison Company, has completed plans for a 4-story brick power house to be erected next spring at 259 West 123rd street.

NIAGARA FALLS, N. Y.—A resolution has been adopted to apply to the Legislature for an amendment to the city charter so as to give the city the right to acquire a plant for municipal electric lighting. The amendment also gives the city the right to acquire the plant of any company by condemnation proceedings.

ROSLYN, N. Y.—The Mineola, Roslyn & Port Washington Traction Company has made another application to the Board of Supervisors of Nassau County for a franchise to construct and operate a street railway in the towns of North Hempstead.

SOUTH WAVERLY, N. Y.—The Waverly Electric Light & Power Company has made application to the Borough Council for a franchise to place poles and string wires for the transmission of electricity in this place.

ASHEVILLE, N. C.—The Asheville Rapid Transit Company has been granted a franchise by the Board of Aldermen for the construction of an electric railway to Overlook Park. It is expected that the line will ultimately be extended to Weaverville, about eight miles from the city.

STATESVILLE, N. C.—J. C. Steele & Son are preparing to install electric equipment in their plant. Four motors and other electrical machinery will be purchased.

WAYNESVILLE, N. C.—Work has commenced on the enlargement and improvement of the Haywood Electric Power Company which will involve an expenditure of $40,000. Two new dynamos will be installed, which with the one now in use will give the plant a capacity of 2,000 hp. The increase in the capacity of the plant is made for the purpose of supplying 1,500 hp to the pulp mill of the Champion Fibre Company, at Canton.

WILMINGTON, N. C.—Application has been made to the General Assemly by N. F. H. Gouvenouer, E. W. Van W. Lucas and others to incorporate the Tidewater Power Company, of Wilmington, with a capital stock of $750,000. The new company will transmit electricity for light and power to this city from the Rockingham Power Company's plant in Richmond County. Hugh McRae & Company, bankers and promoters, of this city, are at the head of the Tidewater Power Company.

BLUFFTON, OHIO.—The citizens are contemplating changing the system of the municipal electric lighting plant from direct to alternating current and installing new equipment. William Plattner is manager.

CINCINNATI, OHIO.—The Cincinnati & Suburban Bell Telephone Company has been granted permission to build conduits for its wires on several of the county roads.

COLUMBUS, OHIO.—The Edison Electric Light Company will make application to the State Board of Public Works for permission to erect poles on the banks of the Miami & Erie canal to Sharon road, leading to Glendale, a distance of about ten miles.

COLUMBUS, OHIO.—An ordinance has been passed permitting the Western Union Telegraph Company to lay conduits in West Broad Street. The intention is to make arrangements with the company by which all wires may be laid in this conduit.

GERMANTOWN, OHIO.—The Germantown Independent Telephone Company has increased its capital stock from $10,000 to $20,000.

HURON, OHIO.—The Council is planning the erection of an electric light plant here.

MANSFIELD, OHIO.—The Mansfield & Wooster Interurban Railroad Company has increased its capital stock from $30,000 to $2,000,000, and has also decided to issue $1,000,000 in bonds the proceeds to be used for construction of the new line. Samuel Kelsey is president.

MILFORD, OHIO.—The question of granting a franchise to the Loveland Light & Power Company for furnishing electricity for lighting and power is being considered by the Council. H. C. Hubbell, of the Loveland Light & Power Company declines to offer any terms unless a 25-year franchise is granted.

PAINESVILLE, OHIO.—The City Council is having plans prepared for rebuilding the municipal electric light plant. H. P. Cumings is city engineer.

RAVENNA, OHIO.—General Superintendent J. R. Curtis, of the Cleveland, Alliance & Mahoning Valley Electric Company, is making estimates on the work of electrifying the old line of the Baltimore & Ohio, recently purchased, and building a short section to connect with the Akron line.

RAVENNA, OHIO.—An appropriation has been made by the Portage County Telephone Company for a new switchboard, extensions and cables in this place. A multiple switchboard, with a capacity of 3,600 subscribers, will be installed.

MANGNUM, OKLA.—At an election held here Feb. 5 the proposition to purchase the electric light plant was defeated by a vote of 43 to 143.

BAKER CITY, ORE.—The City Auditor writes that it is proposed to construct an electric light plant, but nothing definite has yet been done.

MEDFORD, ORE.—F. H. Farrar, superintendent of the city electric light plant, states that the plant is out of date and practically useless. According to his statement the plant is worth about $10,000, and that it would require an expenditure of $15,000 to make it serviceable, while a new plant would cost about $20,000. The majority of the Council favor the employment of an electrical expert to make a thorough examination of the plant and report on the same.

OREGON CITY, ORE.—Ward P. Webber has filed notice of appropriation of 30,000 miners' inches of water from the south fork of the Clackamas River to be used for development of mines and the furnishing of electricity for power and light and other purposes. Three reservoirs will be built.

ROSEBURG, ORE.—The Roseburg water and light systems, owned by A. Welch, have been purchased by a corporation headed by J. L. Kendall and brother, of Pittsburg, Pa. The new management will make extensive improvements.

LEWISTOWN, PA.—The Borough Council on Feb. 5 granted a franchise to the Lewistown & Reedsville Electric Railroad Company for the right of way over certain streets in this borough for a period of 75 years.

MT. AIRY, PA.—Watson & Huckel have invited estimates for the erection for a power plant for the Lutheran Theological Seminary in this place.

NEW BERLIN, PA.—The directors of the New Berlin & Winfield Railroad Company have decided to extend their road to Centreville, and may extend the line to Huntingdon. I. J. Moyer is general manager.

NEWTOWN, PA.—The entire property of the Newtown Electric Street Railway Company was sold recently at trustee's sale to John J. Speece, of Philadelphia, for $100,000.

PHILADELPHIA, PA.—Application has been made to the City Council by the Auto Transit Company for permission to operate electric omnibus lines. The company proposes to install a service June 1 on North Broad Street. The company has a capital stock of $1,000,000. Charles Berg, president of the Imperial Electric Motor Company, is interested in the project. Options on real estate near Broad and Brown streets have been obtained by the company, where it is planned to erect a large power house to charge the storage batteries of the coaches.

PITCAIRN, PA.—The Borough Council is now contemplating the addition of a direct connected set consisting of a 85-hp Westinghouse gas engine and a 50 or 60-kw, alternating-current Westinghouse generator. If this is authorized and installed a day service will be given. P. H. Lichtenfels is manager.

SCRANTON, PA.—C. R. Acker, Director of Public Works, is preparing plans and estimates for a municipal lighting plant.

STEELTON, PA.—The Pennsylvania Steel Company has entered into a contract with the York Haven Water & Power Company for a supply of electricity generated at the York Haven power plant, which will go into effect as soon as the necessary appliances can be installed. At the outset the York Haven plant will furnish about 1,500 horsepower, which is about one-third of the electricity used in the Steel company's various plants and departments. Electricity for operating the Steelton plant will be furnished through the Heat & Power Company, which maintains a sub-station for the York Haven plant.

BURRILLVILLE, R. I.—An act has been introduced by Senator Francis Fagan, of Burrillville, incorporating the Northern Power Company for the purpose of manufacturing and selling gas and electricity for power, heating and lighting purposes in the towns of Burrillville and Gloucester. The incorporators are Francis Fagan, of Burrillville; Charles Potter, of Gloucester, and Charles M. Whittaker. The capital stock of the company is fixed at $250,000.

PROVIDENCE, R. I.—The Scituate Light & Power Company has applied to the General Assembly for a charter for the purpose of manufacturing and distributing electricity for lighting and power in Scituate, Foster, Glocester and Burrillville. The capital stock of the company is $250,000, and the principal office is to be in Providence with subsidiary offices in the above towns. The incorporators are Albert N. Luther, of Scituate; William E. Joslin, Edwin A. Smith and William H. Joslin.

BARNWELL, S. C.—G. B. Todd, of this place is making arrangements for the construction of an electric light plant with a capacity of 150 hp, and to supply about 1,500 lamps, including arc lamps. It is reported that bids have been received on part of the equipment and machinery, which are now under consideration.

CHARLESTON, S. C.—Bids will be received until Mar. 30 by H. H. Rousseau, chief bureau yards and docks, navy department, Washington, D. C., for furnishing 7 electric capstans and accessories for the dry dock No. 1, Charleston, as per specification No. 1527.

ROCK HILL, S. C.—At a recent meeting of the City Council the franchise of the Rock Hill Water, Light & Power Company was declared forfeited and the city instituted proceedings to sell the franchise on

Feb. 15. The city and company have been endeavoring to effect a compromise for which a special meeting of the Council was held Feb. 11, when a committee consisting of J. M. Cherry, J. B. Johnson and J. F. Reid was appointed to take up the matter and report to the Council for its final action.

EMERY, S. D.—The proposition to establish an electric light plant is now being agitated by the Business Men's Association.

CHATTANOOGA, TENN.—The Chattanooga Railways Company has decided to withdraw its application for a franchise on Rossville Avenue, east of the city limits, for its proposed new line to Chickamauga Park. Most of the route from the city limits to Rossville will be on private right of way. D. J. Duncan is general manager.

CHATTANOOGA, TENN.—Franchises have been granted to S. W. Divine and associates by both the city and county for the Tennessee-Georgia Interurban Electric Railway, which is to be built from this city through north Georgia to Spring Place. The company has applied for a charter, with a capital stock of $100,000.

DRESDEN, TENN.—Messrs. Brasfield & Brasfield, of Dresden, have purchased machinery for the installation of an electric light plant. The plant will be a small one to begin with, supplying five business houses with electricity for lighting, and if the demand for electricity is sufficient the owners will probably install a plant to meet the needs of the entire town.

BEAUMONT, TEX.—The Beaumont Ice, Light & Refrigerating Company has filed an amendment to its charter increasing the capitalization of the company from $300,000 to $500,000. The company proposes to broaden and expand the scope of its business.

DENISON, TEX.—The Denison Light & Power Company is considering improvements to its gas and electric plant that will involve an expenditure of $50,000. It is proposed to sell the three 133-cycle belted dynamos now in use, and to replace these units with three direct-connected 60-cycle machines, with a capacity of 750 kw.

HUBBARD CITY, TEX.—J. M. Carroll and associates are organizing a company with a capital stock of $150,000 for the purpose of developing the Hot Mineral Spring water of this city. They will erect a hotel, power house, swimming pool, etc., and will also apply to the City Council for a franchise for a telephone exchange.

SEGUIN, TEX.—The City Council is contemplating the purchase of the electric light plant on the river opposite the water works for $50,000. This will give the city the riparian rights of the falls of Guadalupe on both sides of the river.

GREEN RIVER, UTAH.—The City Council has granted a franchise to Merrit & Cook to construct an electric street car line from the depot to the dam, a distance of about seven miles; also for furnishing electricity for lighting in the city.

OGDEN, UTAH.—The City Council has passed an ordinance granting a franchise to the Ogden Rapid Transit Company.

PROVO, UTAH.—A landslide at Hobble Creek Canyon, Feb. 4, damaged the canal to the extent of $3,000, and the power plant about $4,000, putting the plant entirely out of commission.

PROVO, UTAH.—The Telluride Power Company is contemplating the erection of a power plant having 3,000 hp capacity on Beaver River, for the purpose of furnishing electricity in Newhouse.

LYNCHBURG, VA.—At a meeting of the Common Council held Feb. 7, a resolution was approved looking to a ten-year contract with the Lynchburg Traction & Light Company at 14½ cents per lamp per night without right to purchase the system. This kills finally the effort for a municipal plant.

RICHMOND, VA.—An amendment has been granted to the charter of the Southern Bell Telephone & Telegraph Company of Virginia, increasing its capital stock from $3,000,000 to $6,000,000.

ROANOKE, VA.—The Roanoke Railway & Electric Company announced on Feb. 14 that it will begin at once the construction of a new power plant to cost $225,000 on the site purchased recently from the Norfolk & Western Railway Company. It is the intention of the company to have the plant in full operation by midsummer. The plant will have a capacity of 3,000 hp and will furnish electricity for operating the street car system, electric lighting and power purposes. In addition to the above amount, the company will spend $18,000 this year for the improvement of its street railway facilities.

MT. VERNON, WASH.—The Mt. Vernon Electric Light Company is contemplating the installation of a complete new plant by Nov. 1. W. H. Franklin is manager.

NORTH YAKIMA, WASH.—The Yakima Intervalley Traction Company has decided to call at once for bids for material to equip the road, which will be built into the Moxee Valley and thence to Zillah, a distance of 24 miles. Another line will run to Wide Hollow, west of this city.

POSSER, WASH.—The Prosser Traction Company is arranging to build its proposed road. Forty-five miles of line will be constructed. Frederick Finn. of Prosser, is president of the company.

CLARKSBURG, W. VA.—The Bell Telephone Company will enlarge its quarters in this place and make other improvements at a cost of $20,000.

ELKINS, W. VA.—Two applications for street railway franchises have been made to the City Council of Elkins. The Leadville Power Company recently asked for a franchise, promising to construct a line within three years. Recently the Elkins Electric Railway Company has filed an application for a franchise, with it as evidence of good faith, filed a certified check for $5,000, agreeing that if a franchise is granted that the company will begin construction within the next 90 days.

ARCADIA, WIS.—The Western Wisconsin Telephone Company has filed an amendment to its charter increasing its capital stock from $65,000 to $75,000.

BELOIT, WIS.—The directors of the Beloit Traction Company have decided to issue bonds for the construction of a railway. For further information address Goodwin Block.

FOND DU LAC, WIS.—The Wisconsin Telephone Company is planning extensive improvements to its exchange in North Fond du Lac.

GILMANTOWN, WIS.—C. T. Bundy and W. H. Frawley, of Eau Claire, are interested in a proposition to construct an electric railway to this city.

MILWAUKEE, WIS.—The Plankinton Light, Heat & Power Company has petitioned for a franchise in this city to construct tunnels for heating and lighting purposes in the downtown district of the west side.

SHEBOYGAN, WIS.—O. C. Boehnke, promoter of the Fox River Valley electric railway, which proposes to construct a line from this city to Manitowoc, states that work will commence on the road in the spring, and that the company is now securing estimates for the machinery and engines for the power house, which will be built in Cleveland.

CALGARY, CAN.—The Council has decided upon a municipal street railway system and will build 12 miles of track. Address Mayor Cameron.

REVELSTOKE, CAN.—R. Gordon, manager of the municipal electric light plant, writes that the capacity of the plant will be increased.

PORTAGE LA PRAIRIE, MAN.—A bill has been presented to parliament to incorporate Port la Prairie as a city. The town also asks for power to expropriate the electric light plant of the Central Electric Light Company, which furnishes electricity for lighting and power for the city. The clause provides that in case the company is not willing to abide by the decision of the arbitrators the city may erect a plant of its own.

WINNIPEG, MAN.—The civic board of control has asked the Provincial Government to take no steps towards the establishment of a government-owned telephone system in this city until after April, 1908. Address Magnus Peterson, secretary, Board of Control.

BROCKVILLE, ONT.—The Hannawa Falls Power Company has proposed that the towns of Brockville and Prescott combine and see what minimum amount of power the two towns could use. They will then submit a proposition to furnish power on this side of the river and place it before the people. The water which is dammed at Hannawa Falls is taken from the Rauquet River plant and is sufficient to develop 6,000 hp.

GALT, ONT.—The McGregor, Gourley Co. is preparing to operate its plant by electricity and has ordered 14 Westinghouse motors, aggregating 355 hp, from the Canadian Westinghouse Co.

HAMILTON, ONT.—The Dominion Power & Transmission Company with an authorized capital stock of $25,000,000 has absorbed the Hamilton Cataract Power, Light & Traction Company. The new company will take over all of the Cataract enterprises with the exception of the Hamilton Street Railway. The Cataract Company will remain in existence as an operating company only. The Dominion Company will have direct control of the Terminal Station Company, and will have controlling interest in the H. G. & B. and Hamilton & Ancaster Railways. It is the intention of the company to extend the Radial Railway to Toronto, and to the Niagara frontier, and also to build lines west to Windsor.

HAMILTON, ONT.—The Board of Works on Feb. 5 adopted the report of the sub-committee on lighting appointed to consider what policy the city should pursue in the matter of lighting streets after the present contract expires in 1909, which recommends that bids be asked for 500 arc lamps or their equivalent in Nernst or incandescent electric lamps, and also for 1,000 incandescent gas lamps, in accordance with specifications to be prepared by the city engineer. It further recommends that the committee be continued in office to gather further facts as to the cost of installing and operating the municipal lighting plant.

NIAGARA FALLS, ONT.—The Ontario Power Company has decided to enlarge the capacity of its power house on the Canadian side of the river by extending it 160 ft. in length and adding space for two additional units of 12,500 hp each. W. N. Ryerson is superintendent.

OTTAWA, ONT.—At a special meeting of the directors of the St. Lawrence Power Company, held Feb. 5, George G. Foster, K. C., was elected president, in place of Mr. M. P. Davis, resigned, and Mr. Davis

was elected managing director. Mr. Foster has acquired a large interest in this company, with an option upon the whole of the stock, and this means that he will control the available water power, lighting plant and contracts owned by the St. Lawrence Power Company, and which power is developed on the Cornwall Canal. Mr. Foster confirmed the purchase and also stated that he and his associates would proceed to develop in the early spring the balance of power available.

STEELTON, ONT.—The Council is reported to be considering the question of constructing an electric light plant.

STREETSVILLE, ONT.—Bids will be received until about Feb. 28 by John E. Fielding, C. E., 15 Toronto Street, Toronto, Ont., for erecting a concrete dam and power house for the town of Streetsville.

TORONTO, ONT.—The application of the Toronto Electric Light Company to the Legislature for leave to increase its capital stock from $3,000,000 to $4,000,000 will be opposed by the city. Provincial secretary will be notified that the city has applied for expropriation of the company's plant and that the city wishes to be heard before any decision is given on the company's application. It is understood that the increase in the stock is intended to pay for large improvements to be made in the company's plant.

Company Elections.

MACON, GA.—The Bibb Power Company has been organized by W. J. Massee, John T. Moore, M. Felton Hatcher and M. H. Massee, of Macon John C. Walker, of Macon county, and W. A. Wimbish, of Atlanta. The capital stock of the company is $100,000 to start and the privilege is asked to increase it to $500,000. The purpose of the company is to develop the power of Ocmulgee River wherever it is possible and generate electricity to furnish power for operating the Atlanta & Macon, and the Macon & Albany electric interurban lines.

BAINBRIDGE, N. Y.—At the annual meeting of the BainLridge Telephone Company held recently the following directors were elected for the ensuing year: Willard M. Hastings, John M. Cooper, Ralph W. Kirby, Ralph Corbin, Benjamin Allen, Edward Davis and Charles Kirby.

ROCHESTER, N. Y.—The Rochester Railway & Light Company held its annual stockholders' meeeting Jan. 17. Horace E. Andrews, of Cleveland, is the president, and A. L. Linn, jr., is the assistant secretary and the general auditor. Walter N. Kernan of this city has been made a director of the company. Mr. Linn is the assistant secretary and the general auditor of the Rochester Railway Company, the Rochester & Sodus Bay Company, the Rochester & Suburban and the Rochester & Eastern Rapid Transit Company. Mr. Andrews is the president of the four corporations which are under the control of the Utica & Mohawk Valley Railway Company.

COLUMBUS, OHIO.—The stockholders of the Columbus Citizens' Telephone Company have chosen the following directors: Henry A. Lanman, John Joyce, Jr., E. R. Sharp. Frank A. Davis, L. D. Hagerty, J. B. Hanna, H. M. Daugherty, Charles Griswold and Frank L. Beam.

FREMONT, OHIO.—At the annual meeting of the Farmers' Telephone Company, of Fernwood, the following officers were chosen: John J. Gault, president; J. T. Martin, vice-president; W. R. Scott, secretary; Mayme Holmes, treasurer.

KENTON, OHIO.—At a recent meeting of the directors of the Kenton Telephone Company the following officers were elected: James L. Moore, president; W. A. Norton, vice-president; Chas. H. Shanafelt, secretary; Henry J. Miller, treasurer. Specifications are now being made for a new switchboard.

LORAIN, OHIO.—At the annual meeting of the Black River Telephone Company, held recently, officers were reelected as follows: E. M. Pierce, president; W. Honecker, vice-president; L. A. Fauver, secretary; A. V. Hageman, treasurer; Herman Hageman, assistant secretary.

TOLEDO, OHIO.—At a meeting of the stockholders of the Home Telephone Company held recently, the following directors were elected: James S. Bailey, Jr., M. V. Barbour, W. F. Robison, Clarence Brown, Jay K. Secor, J. J. Manning, Eugene Zimmerman, H. C. Stifel, A. H. Bauer, T. H. Tracy, R. E. Hamblin, T. H. Walbridge, D. C. Shaw and E. J. Marshall.

NASHVILLE, TENN.—At the annual meeting of the Nashville Railway & Light Company, held recently, the following officers were elected for the ensuing year: Percy Warner, president; J. C. Bradford, vice-president; H. C. Walters, secretary and treasurer.

RICHMOND, VA.—At the annual meeting of the stockholders of the Southern Bell Telephone Company of Virginia, held recently, the following officers were elected: Edward J. Hall, of New York, president; W. T. Gentry, of Atlanta, vice-president; D. J. Carson, of Atlanta, treasurer; Hunt Chipley, of Atlanta, secretary; J. M. B. Stoxsey, of Atlanta, auditor; J. Epps Brown, general manager. The directors decided to make application to the State Corporation Commission for an amendment to its charter, asking that it be allowed to increase its capital stock from $3.000,000 to $6,000,000.

MILWAUKEE, WIS.—At the annual meeting of the Milwaukee Electric Railway & Light Company, held Feb. 4, George P. Miller was elected director to fill the vacancy caused by the resignation of F. G. Bigelow. Directors of the Milwaukee Light, Heat & Traction Company were elected as follows: John I. Beggs, Charles F. Pfister, George R. Sheldon. George P. Miller was elected to fill the unexpired term of F. G. Bigelow, resigned.

STURGEON, WIS.—At a meeting of the Casco & Brussels Telephone Company, held recently, the following officers were elected for the coming year: W. P. McGrath, president; John Albrecht, vice-president; Joseph Nemetz, secretary and treasurer. George J. Bottkol and Louis Rubens and A. Gaulke, directors. Several extensions are to be made to its lines in the spring.

FREDERICTON, N. B.—A meeting of the directors of the New Brunswick Telephone Company was held recently to appoint a successor to Hon. A. G. Blair, deceased. Dr. Stockton, M. P., St. John, was elected to the vacant presidency; W. T. Whitehead, vice-president, with J. D. Hazen and Charles Fawcett, directors.

SHERBROOOKE, QUE.—At the annual meeting of the Sherbrooke Power, Light & Heat Company the following were appointed directors: Justice White, F. P. Buch, M. Read, A. G. Lomas and C. W. Cate. At a subsequent meeting Justice White was elected president.

New Industrial Companies.

THE DAGG BOILER EQUIPMENT COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $50,000, by B. C. Neff and others, for the purpose of constructing electric light and power plants.

THE ELECTRIC MASSAGE VIBRATOR COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $2,000, by James Groman, C. F. Sweeney and Harold Taylor, of New York.

THE GREEN ELECTRICAL MANUFACTURING COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $7,500, for the purpose of manufacturing and dealing in electrical goods. The incorporators are William L. Lawton and others.

THE MOHAWK ELECTRICAL COMPANY, of Albany, N. Y., has been incorporated, with a capital stock of $10,000, by E. H. Rollins and others.

THE MUNICIPAL PATROL COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $1,000. The directors are: J. D. MacAno, J. J. Donohue and V. A. MacAno, 4 Roosevelt Street, New York.

THE POLICE & FIRE ALARM TELEPHONE COMPANY, of Rochester, N. Y., has filed articles of incorporation, with a capital stock of $500,000. The directors are G. F. Roth, C. P. Chapin and Clarence W. McKay, of Rochester.

THE PRESCOTT MFG. COMPANY, of Germantown, Philadelphia, Pa., will take over the plant of the Prescott Turbine Engine Company, and will spend several thousand dollars in purchasing new machinery to equip the plant for the manufacture of turbine engines. Rowland Croskey is president; James C. Prescott, vice-president; H. C. Potts, secretary, and William R. Taylor, treasurer. Henry A. Prescott is general manager.

THE REIS CIRCUIT COMPANY, of Jersey City, N. J., has been incorporated, with a capital stock of $500,000, by B. S. Mantz, John H. Turner and H. O. Coughlan.

THE SULLIVAN INSULATION COMPANY, of New York, N. Y., has been incorporated, with a capital of $10,000. The directors are J. S. Durand, New York; John Bowen, New York, and Maurice Sullivan, Brooklyn.

THE TELEPHONE TABLET & INDEX COMPANY, of New York, N. Y., has filed articles of incorporation with the Secretary of State, with a capital stock of $15,000. The directors are W. M. Smith, Richmond Hill; J. E. Bennett, Brooklyn, N. Y., and Elizabeth M. King, of Jamaica, N. Y.

THE WATER SUPERVISOR COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $10,000, by Thomas J. King, of Tompkinsville; Charles T. Weeks, of Jersey City, N. J.; and Charles Curran, Brooklyn. The purposes of the company is the inspection and supervision of supply of gas, water, electricity, steam or power.

THE WATERBURY LIGHT & EQUIPMENT COMPANY, of Waterbury, Conn., has filed a certificate of incorporation with the Secretary of State for the purpose of dealing in metals and real estate. It has a capital of $100,000 and the incorporators are Charles H., Clara A. and Otto J. Grelle.

THE WALLACE-SMITH COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $10,000, by W. J. Wallace, New York; A. F. Stanley and W. J. Smith, New York. The company will deal in electrical supplies.

THE WARREN ELECTRIC MANUFACTURING COMPANY, of Augusta, Me., has been incorporated, with a capital stock of $175,000, to manufacture all kinds of electrical machinery. The officers are M. M. Spinney, president; E. J. Pike, treasurer, and C. L. Andrews, clerk, all of Augusta.

New Incorporations.

REDLANDS, CAL.—Articles of incorporation have been filed for the Redlands & Yucaipe Electric Railway Company by C. S. Chesnut, president; George H. Dunn, O. D. Collins, O. M. Miller and A. A. Moore. The company is capitalized at $1,000,000. The Home Gas Company is interested in the road and will probably furnish power for operating the line.

SAN BERNARDINO, CAL.—The Union Home Telegraph & Telephone Company, with a capital stock of $10,000,000, has been incorporated by John M. C. Marble, J. E. Fishburn and Geo. Ellis, to build a telephone line from San Diego to Los Angeles and Bakersfield; Los Angeles to San Bernardino; Los Angeles to Santa Barbara, 1,500 miles in all.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Big Creek Light & Power Company, with a capital stock of $500,000, by Leo H. Susman, M. W. Pryor, Joseph Hafer, Jr., Walter J. McLean and Joseph C. Love.

SIERRA MADRE, CAL.—The Sierra Madre Telephone & Telegraph Company has been incorporated, with a capital stock of $50,000, by W. E. Ferman, F. M. Hawes and others.

GEORGETOWN, COL.—Articles of incorporation have been filed for the Commonwealth Power & Electric Company, with a capital stock of $2,000,000. The directors are Henry Kneisel, Frank A. Maxwell, J. W. Aylor and others. The company will furnish electricity for lighting and power in the counties of Clear Creek, Gilpin, Grand, Eagle, Routt and Summit.

MACON, GA.—At the annual meeting of the stockholders of the Macon Railway & Light Company, held recently, new officers and a board of directors were elected as follows: Herman Myers, president; Sego Myers, vice-president; J. H. Hertz, secretary and treasurer; J. T. Nyhan, general manager. The directors are: E. G. Harris, T. J. Carling, Morris Happ, Henry Horne, Leon Dure, S. Guthman, J. H. Hertz, J. H. Fall, Sego Myers, Jacob Collins, Jacob Paulson and W. W. Osborne and Herman Myers.

LENA, ILL.—Articles of incorporation have been filed for the Lena Electric Light & Power Company, with a capital stock of $12,000, by G. W. Benfer and others.

MARSHALL, ILL.—The People's Mutual Telephone Company has been incorporated, with a capital stock of $5,000, by James Davison and others.

LADOGA, IND.—Articles of incorporation have been filed with the Secretary of State by the Parkersburg Telephone Company. F. A. Scott, James Akers, Henry Fall and D. S. Armstrong consitute the board of directors.

DEXTER, IA.—The Mosher Mutual Telephone Company has been incorporated with a capital stock of $5,000 by George Elliot and others.

LA PORTE, IA.—The La Porte City Farmers' Telephone Company has been incorporated with a capital stock of $24,000. O. A. Wallace is president.

MARENGO, IA.—The citizens of Marengo have organized and incorporated the Marengo Midland Railroad Company for the purpose of building an interurban line from this city to Millersburg, and thence to Fairfield.

AURORA, NEB.—The Farmers' Telephone Company has been incorporated with a capital stock of $10,000.

LISBON FALLS, N. H.—An act to incorporate the Lisbon Falls Gas & Electric Company is before the State Legislature. The company is capitalized at $50,000, and proposes to supply gas and electricity in Lisbon Falls, Durham and Topsham. The incorporators are: F. C. Whitehouse, William H. Newell, W. E. Plummer and H. E. Plummer.

MORRISTOWN, N. J.—The Kennedy Electric Company has been incorporated, with a capital stock of $25,000, by John C. Kennedy, Emil Podlesake and Robert Kennedy.

SINCLAIRVILLE, N. Y.—The Sinclairville Independent Telephone Company has been incorporated with a capital stock of $5,000 by E. J. White and others.

CLEVELAND, OHIO.—The Warner Electric Company of this city has been incorporated, with a capital stock of $15,000, by E. L. Warner and others.

Legal.

RIGHT TO RECOVER PROFITS FROM INFRINGER OF PATENT.—In an action at law, brought by an inventor or the owner of a patent against an infringer, the owner or inventor, as the case may be, is entitled to recover only such damages as he can show that he has actually sustained, such, for instance, as the loss of particular sales resulting from the acts of the infringer. He cannot, in an action at law, recover profits made by the infringer through dealing in the invention or infringement thereof. The profits may be recovered, however, in an action in equity to secure an injunction to restrain the infringement. Brown vs. Lanyon, United States Circuit Court of Appeals, 148 Fed. Rep. 838.

EVIDENCE ADMISSIBLE IN ACTION FOR PERSONAL INJURIES.—In an action against a telephone company brought by an employe to recover damages for injuries received as a result of the falling of a pole upon which he was working, the plaintiff alleged that he was "bruised and lacerated in and about his body, face, head, legs and arms, and was thereby injured, sprained, strained, wrenched, and shocked on his body, legs, head, arms, back, spinal column, spinal cord, hips, hip joints, and bruised, injured and lacerated in the bones, ligaments, nerves, muscles and tendons thereof, breaking his left arm, and thereby injuring his left arm and hand to such an extent as to cause it to become permanently stiff and paralyzed and incurable, and useless to him for any character of work, particularly that of a telephone lineman." Under this allegation, it was held that the plaintiff might introduce evidence as to a gash over the eyes and a blue spot on the hip, but that evidence as to a dislocation of the knee and wrist was inadmissible. Southwestern Telegraph & Telephone Company vs. Tucker, Court of Civil Appeals of Texas, 98 S. W. 909.

USE OF STREETS BY TELEPHONE & TELEGRAPH COMPANY.—The State Line Telephone Company, holding a franchise from the Village of Peekskill, N. Y., erected its poles and wires in one of the streets of the village without the consent of one of the abutting owners and without acquiring any right by condemnation proceedings. The abutting owner owned the fee of that portion of the street in front of his property, his ownership being subject to the usual easements which arise from a dedication of the street for public purposes. In an action by the abutting owner to require the telephone company to remove its poles and wires from in front of his premises it was held that the telephone company had no right to appropriate any portion of the public highway, however small, to its own permanent use, against the consent of the abutting owner or without having the property condemned as provided by law. Where land is dedicated or taken for a public highway the primary use implied is that of travel or passage over the highway. The title to the fee of the highway generally remains in the adjoining owner, and he retains the ownership of the land, subject only to the public easement. And the public easement does not include the right of a telephone company to erect in the highway any permanent structure whatever. Powers vs. State Line Telephone Company, Appellate Division, Supreme Court of New York, 102 N. Y. Supp. 34.

RIGHT OF ELECTRIC LIGHTING COMPANY TO TURN OFF POWER BECAUSE OF DEFECTIVE WIRING INSTALLED BY CUSTOMER.—An electric lighting company installed a meter in a dentist's office and did the necessary wiring for a bull's-eye reflecting light in front of the operating chair. The dentist subsequently strung some wires himself for the purpose of connecting the current with an electric sign outside his window and with a lathe which he used in his work. The lighting company later informed the dentist that the wiring which he had put in was defective and dangerous and that it was liable to set fire to a lady's dress or to the building. The defective wiring was then removed by the company and the dentist agreed not to connect it again. He did not abide by his agreement, however, and the company, upon finding the wires replaced, was compelled to resort to the expedient of shutting off the electricity. The dentist was left without illumination for a period of about nine days and brought an action against the company to recover damages occasioned by the refusal to furnish him with light. It was held that the dentist had contributed to his loss by refusing to put his wires in safe condition and that he was, therefore, not entitled to recover damages. There was no refusal on the part of the company to furnish electricity under proper conditions. The current was turned off only as a last resort, and the company was held to have been clearly within its rights when it refused to longer allow its electricity to run through defective wires. Had any injury resulted from the defective wiring the company would have been liable and it was under a legal duty to exercise the utmost care to avoid injury to those whose business or pleasure brought them near the wires through which its electricity flowed. In turning off the current the company was merely living up to this legal obligation. Benson vs. American Illuminating Company, Steuben County Court, New York, 102 N. Y. Supp. 206.

TELEGRAPH COMPANY NOT RELIEVED FROM LIABILITY BY STIPULATION ON BACK OF MESSAGE BLANK.—The recent case of Walker vs. Western Union Telegraph Company, decided by the Supreme Court of South Carolina, 56 S. E. Rep. 38, holds that a telegraph company cannot relieve itself from liability to the sender of a message by a printed stipulation on back of the blank that the company shall not be liable in damages for mistakes in the transmission of repeated messages beyond 50 times the amount received for sending the message. Like every other corporation or individual engaged in a public business, a telegraph company has the right to provide reasonable rules and regulations for the conduct of its business, but this right is subject to the limitation that the rules adopted must not be such as tend to relieve the company of the obligations which the law and public policy imposes upon it. Though the general rule is that a telegraph company cannot, by special contract or otherwise, evade liability for the consequence of its own negligence or that of its servants, there is a class of cases which maintain the view that the company may exempt itself from liability except for damages resulting from "gross negligence" or wilful default. These cases attempt to distinguish between mere negligence and gross negligence, holding that the company can contract against liability for the results of the former. In Wisconsin, Missouri, Maryland and in a few other jurisdictions it has been held that the company may contract to relieve itself from liability from inadvertence or mere negligence, but not from gross negligence or bad faith. The better rule and that

representing the weight of authority is that a telegraph company is liable in damages for failing to exercise that degree of care and skill which a careful and prudent man would, under the circumstances, employ, regardless of any stipulation printed on the message blank even though the stipulation be voluntarily assented to by the sender of the message.

PATENT FOR AN ELECTRIC CURRENT REGULATOR HELD VALID.—In an opinion written by District Judge Hazel, patent No. 430,868, granted to Cyprien O. Mailloux, June 24, 1890, for automatically regulating electric currents is pronounced valid. The invention is principally applicable to circuits which are subject to marked changes of load or sudden and violent fluctuations of the current energy, as in electric railway circuits, where the variations of load are very rapid. The claim of the owner of the Mailloux patent that the device was infringed by the Hubbard patent, No. 651,654, was not upheld, the patentable novelty in the former invention lying in the fact that the regulating coil was placed in the working circuit, while in the Hubbard device the regulating coil is in the generator circuit. Electric Storage Battery Company vs. Gould Storage Battery Company, United States Circuit Court, 148 Fed. Rep. 695.

Educational.

UNIVERSITY OF MISSOURI.—The Engineering Society of the University has undertaken the publication of a Quarterly devoted to the interest of engineering and kindred sciences. The staff consists of a business manager, an editor-in-chief and six associate editors, selected from the senior and junior classes. Among other articles the first issue contains a paper on the electric drive, by Prof. H. B. Shaw, a discussion of Ohm's law, by Prof. O. M. Stewart, and a description of the first electric lighting system in Missouri, by Samuel D. Gomer.

Obituary.

LEON SERPOLLET, a French engineer, and well-known as an inventor of an automobile engine and other devices, died Feb. 11 at the age of 48 years.

Personal.

MR. C. DICKERSON has succeeded Mr. S. Allard as superintendent of the Grand Forks, Neb., municipal lighting plant. He was formerly connected with the local Gas & Electric Company.

MR. MARK B. BEATTIE announces the opening of his office for the practice of electrical engineering, in the Commercial Building, Louisville, Ky., where he is now installed.

DR. M. V. SCHOOP, a well-known European authority on the storage battery, is on a short visit to this country. One of the latest inventions of Mr. Schoop is the welding of aluminum.

MR. L. M. PIGNOLET, the manufacturer of electrical measuring instruments, is taking a trip to Europe and will be gone some five or six weeks. He will visit London, Paris and other cities.

MR. J. K. JOHNSON, vice-president and general manager of the Tuscarawas County Telephone Company, of New Philadelphia, Ohio, has been chosen general manager of the Sandusky Telephone Company, Sandusky, Ohio, succeeding A. H. Elmore.

MR. THOMAS H. BIBBER, for the past five years with the American Circular Loom Company, Chelsea, Mass., has resigned and accepted the position as manager of sales for the American Conduit Mfg. Company, with headquarters in the Keystone Building, Pittsburg, Pa.

MR. E. P. COLEMAN, of Montpelier, Vt., formerly manager of the Attleboro electric light and power system is understood to have accepted the position of general manager of the Great Northern Power Company, of Duluth, Minn.

MR. F. N. BUSHNELL has resigned as chief engineer of the Narragansett Electric Lighting and Rhode Island Companies in order to join the forces of the Stone & Webster Engineering Corporation. He has been associated with Mr. Marsden J. Perry ever since 1893 and has made his mark as a power house engineer and designer of great ability.

MR. J. C. HENDERSON, formerly with the American Telephone & Telegraph Company and the Western Electric Company of Chicago, has joined the forces of the Westinghouse Electric & Manufacturing at the Cincinnati, O., office and will travel in that territory in the Westinghouse interests. His experience has well equipped him for the work in hand.

MR. ALBERT H. STANLEY, who was recently made general manager of the trolley systems of the Public Service Corporation of New Jersey, has tendered his resignation to accept a similar position with the London Underground United Railways Company. Mr. Stanley will sail for England on April 1. He is an Englishman by birth, but has been in this country several years.

MR. RALPH D. MERSHON sailed Feb. 16 for London, England, to take up there matters relative to the Victoria Falls power scheme, in connection with which he has been retained for sometime past. Mr. Mershon does not contemplate visiting South Africa at this time in connection with this work. His present trip will not extend beyond London, Paris and Berlin, and his absence from this country will be limited to about thirty days.

MR. FINDLAY S. DOUGLAS has been appointed manager of motor and generator sales of the New York office of the Sprague Electric Company. Mr. Douglas has been connected with the sales department of the Sprague company for a number of years and has been successful in closing many important contracts. Aside from his extensive acquaintance in the electrical field, he has also an international reputation as a crack golfer, having held the title of amateur champion of the United States.

MR. J. W. DUNTLEY, president of the Chicago Pneumatic Tool Company, has returned from a five weeks' business trip to Europe, arriving Feb. 5. He reports the pneumatic and electrical tool business in flourishing condition on the continent and a decided improvement in England since his visit the early part of December last. Business generally is slightly in excess of the corresponding period last year and reports received from various points would indicate that the year 1907 will equal the preceding year.

MR. ERNEST GONZENBACH, who has been vice-president and general manager of the Sheboygan Light, Power & Railway Company for the past two years, has had added to his duties the general management of the Greensboro (N. C.) Electric Company, which operates the gas, electric light, street railway and city pumping station of Greensboro. He will divide his time between Sheboygan and Greensboro, according to the needs of the two properties. The net receipts at Sheboygan have increased 100 per cent in the two years he has been there, and the gross receipts about 25 per cent, according to recent reports.

MR. G. WESTINGHOUSE, JR.—The engagement is announced in England of Miss Evelyn Violet, youngest daughter of Sir Thomas and Lady Brocklebank, of Liverpool, England, and Mr. George Westinghouse, Jr., only son of Mr. and Mrs. George Westinghouse. Sir Thomas Brocklebank is a baronet and succeeded his father in 1906. He married in 1872 Miss Agnes Lydia Allport, daughter of Sir J. J. Allport. Mr. George Westinghouse, Jr., has lived the greater part of his life in Washington, D. C., and also in Lenox, Mass. He is about twenty-three years old, and has lately taken up engineering work in the Westinghouse fields of industry.

MR. C. M. GRAVES.—Following the recent resignation of R. F. Blackwell as general manager of the Coeur d'Alene & Spokane Railway, comes the announcement by Jay P. Graves, president of the Spokane & Inland Empire system, of the appointment to that position of Clyde M. Graves. Mr. Blackwell's resignation will not take effect until some time in March, when Mr. Graves will assume the management. Mr. Blackwell was one of the original incorporators and builders of the Coeur d'Alene line and has been its general manager since its inception three years ago. He leaves the road to devote his entire time to his lumber interests. Mr. Graves will continue in his present position as general manager of the Spokane Traction Company after assuming the management of the Coeur d'Alene division next month.

MUDGE & NEEFUS is the designation of an engineering partnership recently entered into by Mr. Chas. A. Mudge and H. H. Neefus. The firm has opened offices at 20 Broad Street, and will practise as railway and electrical engineers, and advisers on the design and construction of motors, generators, brakes, systems of control, etc., for railway service. Mr. Mudge has been connected in an engineering capacity with the Westinghouse, Sprague and Bullock companies, and in 1903 designed for the A. E. G. of Berlin a line of railway apparatus which, when manufactured, met with much success. He also represented the latter company in the Zossen high-speed tests. Since his return to this country Mr. Mudge has been the engineer of the railway department of the Electrodynamic Company. Mr. Neefus has been engaged in general engineering and contracting work in different parts of the United States, and more recently has been on the staff of the Electrodynamic Company, manager of the Von Zweigbergk Controller Company, and secretary of the Suergard Sanitary Engineering Company.

Trade Publications.

TIME SWITCHES.—Albert & J. M. Anderson Mfg. Co., Boston, Mass., has just issued a handsome catalogue pamphlet devoted to its time switch, which is therein fully illustrated and described in detail. The cover is strongly embossed in red, gold and gray, showing the box of the switch mechanism.

GARVIN TOOLS.—The Garvin Machine Co., Spring and Varick Streets, New York City, has issued a very neat and handy little pamphlet in regard to its motor-driven machine tools. It illustrates, with data, a number of milling machines, tappers, profilers, die slotters, lathes, etc., all of them made more serviceable by the incorporation of the motor into the device.

SINGLE-PHASE RAILWAY.—An interesting description of the complete equipment of the Toledo & Chicago Interurban Single-Phase Railway is given in Bulletin No. 4479 of the General Electric Company, Schenectady, N. Y. The motors are of the compensated single-phase type wound for 250 volts and 25 cycles. There are four motors per car, each being rated at 75 hp.

PIPE-THAWING TRANSFORMERS.—Among the many special uses to which a transformer may be put and for which the standard design may be improved upon by minor changes, none is of more importance

than the thawing of ice in pipes. The General Electric Company, Schenectady, N. Y., has issued as bulletin No. 4480, a convincing argument of the advantages of its pipe-thawing transformers for this special duty.

CHARLES WIRT & COMPANY, 4901 Stenton Avenue, Philadelphia, have issued bulletin No. 107 as to their Di-el-ite resistance units. In moulding the very finest wires into Di-el-ite, the material is applied to the consistency of cream, and a partial vacuum is employed to eliminate minute air bubbles, while a pressure of about 100 pounds per square inch expels the greater part of the liquid and gives solidity sufficient to permit handling. By the subsequent hardening process the material becomes stone of a hardness which will put an edge on a steel cutting tool. The units are made up in exceedingly compact, convenient and minute form.

Business Notes.

THE BELDEN MANUFACTURING COMPANY, of Chicago, has found that the growth of its business makes additional floor space necessary. It has therefore leased a five-story and basement building at 190 Michigan Street, affording it a 50 per cent increase. It will use this building in addition to its present factory at 192 and 194 Michigan Street.

THE BROOKLYN NAVY YARD has just purchased a quantity of Voltax, the high-potential insulating compound, for use in electric installation work at that place. It is said that this new compound is gradually replacing the rubber insulating compounds, not only because it possesses all the desirable qualities of rubber, but because it is not so susceptible to climatic conditions and can resist a greater voltage, and is less expensive.

MASSACHUSETTS CHEMICAL COMPANY, of Walpole, Mass., has a number of specialties catering to important necessities in the electrical field. Among these are "Armalac," the plastic insulating compound; "Insullac," a transparent insulating compound, and "Enamelac," a rapid drying black insulating paint. "Special armalac" is an improved permanently plastic and highly adhesive insulating varnish. In addition there are "M. C." No. 50 insulating compound for armatures, field coils, etc.; "M. C." waterproof friction tape, and "M. C." paints; also "Walpole shellac," "Dyfield" tape and other splicing, cementing, insulating and protective compounds, in themselves ranging in application over the whole field of electrical work.

THE HALLER MACHINE COMPANY SIGN WORKS, of 319 South Clinton Street, Chicago, have recently removed from their former quarters to a large and commodious new factory, especially prepared for their class of work, the removal being necessary on account of the growing demand for Haller signs and letters. The new plant is equipped with a full complement of tools and machinery for turning out their special patented goods. The working force, both in shops and office, has been increased, in order to properly take care of their increasing business. All correspondence should be addressed to 319 S. Clinton Street, instead of to 129-147 Fulton Street, as formerly. The Haller Machine Company has just finished an electric roof sign for the Oliver Chilled Plow Works, South Bend, Ind. The height of letters is 18 feet, and the trade mark containing a letter C, 40 feet high, 60 feet wide, also a plow of 60 feet long. The entire sign will be 250 feet long. The construction is of the Haller patent grooved type. This is the second order the Oliver Chilled Plow Works has given to the Haller Machine Company for a large roof sign, one having been filled about one year ago.

H. W. JOHNS-MANVILLE COMPANY IN BUFFALO.—Within the past few months new branches has been opened by the above company at New Orleans, Dallas and Baltimore, so that the company now has 16 branches throughout the United States, besides innumerable local representatives at various points. The business of the company in the city and vicinity of Buffalo has now reached such proportions that a new branch has just been opened at 214 Main Street, Buffalo. This branch consists of a large retail store, offices and warerooms, and will be under the management of Mr. George A. Schmidt, who for a number of years was connected with the Manville Covering Company. Mr. Schmidt is well known throughout that section, having until recently been in charge of a special department of the W. A. Case & Sons Manufacturing Company, Buffalo, who were the Buffalo agents of the H. W. Johns-Manville Company. Mr. B. T. Boscoe has been appointed assistant manager of this branch, and will make his headquarters in Rochester. Mr. Harry V. Patton, formerly manager for a local asbestos house, will also be associated with the new Buffalo branch.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED FEB. 12, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

843,616. DETINNING APPARATUS; Meredith Leitch, Elizabeth, N. J. App. filed July 5, 1906. Relates to apparatus for electrolytically detinning tin scrap,

843,694. REEL FOR MINE LOCOMOTIVES; Charles O. Palmer, Cleveland, O. App. filed Dec. 17, 1906. Patentee has a horizontally journalled reel with a gear and sprocket connection to the wheels of the tram car so that the reel automatically winds up the cable when the car returns on its track.

843,703. RAILWAY SIGNAL SYSTEM; Alfred L. Ruthven, Topeka, Kan. App. filed Apr. 20, 1906. Patentee has a special third rail between the track rails which is deflected at intervals so as to exert a cam guide action to throw a switch on the car in addition to its function of establishing a signal circuit. The purpose is to provide a block signal system.

843,730. LOCKING DEVICE FOR DOORS AND WINDOWS; Josef Wittmann, Munich, Germany. App. filed May 24, 1905. The door has a pivoted bar or lever which is received in sockets so as to lock the door, but which may be tripped by an electromagnet into unlatched relation.

843,731. ARRANGEMENT FOR REGULATION OF SPEED OF COMPENSATED SINGLE-PHASE MOTORS; Engelbert Arnold, Karlruhe, Germany, and Jens Lassen LaCour, Edinburgh, Scotland. App. filed June 1, 1905. Has a single phase compensated motor and an induction regulator for starting and speed regulating.

843,733. ELECTRIC REGULATOR; Augustus C. Carey, Boston, Mass. App. filed July 15, 1904. Iron filings are contained in a tube between two movable magnet poles so as to form an electrical resistance element whose resistance varies with the separation of the poles.

843,735. STARTING RHEOSTAT; Lewis S. Chapman, Schenectady, N. Y. App. filed June 9, 1906. Prevents the reversal of a motor being made quickly in such a way that it acts temporarily as a generator assisting the line voltage and producing an abnormally heavy current. Has means whereby the starting arm is positively returned to starting position by a reversal.

843,739. ELECTRIC INSULATOR; Frederick A. Feigert, Shelbyville, Ind. App. filed Mar. 19, 1906. An insulator having a saddle on its upper surface for a messenger cable and a hanger depending therefrom to support the trolley.

843,746. SELECTIVE TRANSMITTER SYSTEM; John L. Hall, Schenectady, N. Y. App. filed Dec. 9, 1901. A selective signaling system employing a limited number of wires in which potentials of different polarities are applied to pairs of the wires in different combinations.

843,749. BRAKE CONTROL SYSTEM; Laurence A. Hawkins, Schenectady, N. Y. App. filed Oct. 8, 1904. Each car of the train is equipped with a complete pneumatic brake system controlled by a local engineer's valve which is operated by an electrical pilot circuit extending throughout the train.

843,753. STARTING DEVICE FOR ELECTRIC MOTORS; Arthur C. King, Madison, Wis. App. filed June 9, 1906. The starting arm of the rheostat has a detent which prevents it from moving until the detent is released by an electromagnet in the field magnet circuit. Prevents motors starting when the fields are de-energized.

843,761. TROLLEY RETRIEVER; Francis M. Miller, Arcadia, Ind. App. filed Apr. 22, 1905. A sprocket and gear connection is provided from the car wheels to a drum which is clutched into action to retrieve the trolley pole when the latter leaves the wire.

843,763. CONNECTOR OR TERMINAL FOR ELECTRICAL CONDUCTORS; James McLaughlin, New York, N. Y. App. filed Sept. 11, 1901. A railbond having a specially constructed drift pin or stud which is hammered through the usual lug of the bond so as to rivet the same to the web of the rail.

843,774. ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE; Charles P. Steinmetz, Schenectady, N. Y. App. filed Nov. 28, 1905. In a dynamo-electric machine, relatively rotatable primary and secondary members, connections for supplying alternating current to the primary member, and means for supplying to the secondary member low-frequency currents derived from the primary member.

843,775. ELECTRIC HEATER; Samuel W. Taliaferro, aSn Francisco, Cal. App. filed July 31, 1905. A circular tray has a resistance element embedded therein and is adapted to be inserted in a small specially constructed stove or heater on which the dental tools may be placed.

843,776. ELECTRIC FURNACE; Edward R. Taylor, Penn Yan, N. Y. App. filed May 15, 1902. A metallurgical furnace having a reaction zone, and means for feeding portions of the charge through a surrounding body of the charge to said chamber.

843,777. METALLURGICAL PROCESS; Edward R. Taylor, Penn Yan, N. Y. App. filed May 27, 1902. The herein-described metallurgical process, which consists in feeding a suitable charge downwardly in proximity to the periphery of a furnace, and feeding portions of said charge inwardly through a surrounding body of the charge to a central reaction zone.

843,805. RESIDENCE MAIL BOX; William H. Granger, Oklahoma, O. T. App. filed Feb. 26, 1906. The cover of the mail box has a mechanical connection to a switch by which a signal bell is operated when mail is deposited in the box.

843,814. MEANS FOR CONTROLLING VALVES OR OTHER MOVABLE DEVICES FROM A DISTANT STATION; Edward M. Hewlett, Schenectady, N. Y. App. filed May 29, 1906. A current of positive or negative potential is obtained from a three-wire system and operates a polarized switch to actuate the valve motor in either selected direction.

843,844. THIRD RAIL INSULATOR; Robert N. Redmayne, Newcastle-upon-Tyne, England. App. filed Mar. 12, 1906. Specially formed insulating block having overhanging ledges on all sides so as to shed dampness and moisture and keep the insulator dry.

843,852. FUSE OR ELECTRIC CUT-OUT; Charles A. Steller, Jr., Jersey City, N. J. App. filed May 28, 1906. A small metallic box with lugs by which it is attached to the panel board. Has metallic clips inside to which an ordinary fuse wire is attached.

843,871. TELEPHONE TRUNKING SYSTEM; William W. Dean, Chicago, Ill. App. filed July 19, 1902. Complete diagram of the cord circuits for a trunking exchange system and having testing terminals connected with the talking circuit during conversation.

843,890. CONNECTION FOR ACOUSTICONS; Howell W. Haff, Babylon, N. Y. App. filed Mar. 17, 1906. A plan for connecting telephone transmitters in a multiple circuit by means of two sheet metal stampings which have projecting arms to receive the various terminals. The arms project into convenient proximity to the transmitters so that the connections are readily made.

843,891. TELEPHONE RECEIVER; Howell W. Haff, New York, N. Y. App. filed Aug. 27, 1906. A convenient switch for a telephone re-

ceiver which has a blade co-operating directly with the sleeve-contact of a plug so that there are only two contact elements in the receiver circuit although both a plug and a switch are provided.

843,900. ELECTRIC LIGHT BULB; Frank E. Lerberg, Newark, N. J. App. filed Mar. 8, 1906. The glass of the lamp has a double seal for the terminal wires or leads and also has a small pointed rod fused therein so that the lamp may be stuck into a wooden bench temporarily or in any desired position.

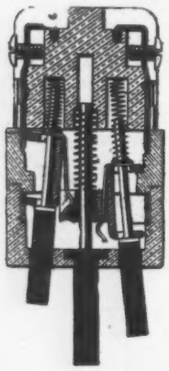
843,901. ELECTRIC SWITCH; Herman J. S. Lewis, New York, N. Y. App. filed July 2, 1906. A multiple pendent switch of very compact construction. Provides for closing any desired lamp circuits by depressing appropriate buttons. All of the lamp circuits are simultaneously broken by depressing a single release button.

843,902. MULTIPLE ELECTRIC SWITCH; Herman J. S. Lewis, New York, N. Y. App. filed Aug. 9, 1906. Relates to another construction for accomplishing the same purpose. In this case a cam drum is turned so as to successively close the lamp circuits one after the other. The circuits are opened by a reverse movement of the cam drum. The circuits are opened and closed by an abrupt movement of knife blade switches.

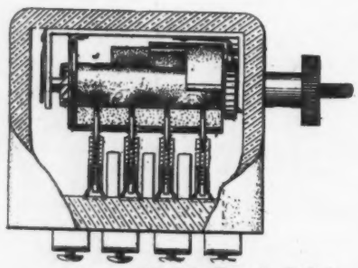
843,904. ALARM; Charles Mahla, West Hoboken, N. J. App. filed Aug. 21, 1906. A form of alarm device designed to be hung on a door knob. Has an arm with a friction connection to the knob which closes an alarm circuit in case the knob is turned.

843,916. INSULATING SADDLE-STAPLE; Walter T. H. Taylor, Brockton, Mass., William J. Jenks, New York, N. Y., and Richard N. Dyer, East Orange, N. J. App. filed Nov. 20, 1906. As a new article of manufacture, an insulating saddle-staple having a saddle made of two thicknesses of insulating material formed of one piece of material folded upon itself at right angles to the plane of the legs of the staple, the upper thickness only being pierced by the legs of the staple, substantially as set forth.

843,919. ELECTROMAGNET; John E. Washburn, Egmont, Fla. App. filed July 28, 1906. A plurality of soft iron discs are supported



843,901.—Electric Switch.



843,902.—Multiple Electric Switch.

within a magnet winding so as to be capable of operating throughout the series or closing together in a compact group. May be used as a telegraph sounder.

843,929. ALARM FOR GAGES, CLOCKS, ETC.; Adelard Charland, Lake Megantic, Quebec, Canada. App. filed Dec. 30, 1905. Form of pressure gage having a pair of contact springs in the path of the usual pointer which are impelled into contact with one another to close an alarm circuit.

843,930. NON-ARCING MUFFLED FUSE; Frank B. Cook, Chicago, Ill. App. filed June 12, 1905. An inclosed fuse comprising a suitable tube or casing, an asbestos cord and a fusible conductor side by side in the tube.

843,940. ANTISEPTIC GUARD FOR TELEPHONE-TRANSMITTERS; Gerhardt E. Grimm, Camden, N. J. App. filed Aug. 12, 1905. In a guard of the character described, a plate having an opening, means for securing the plate in position upon the mouth of a transmitter, one edge portion of said plate being bent to constitute a cylindrical housing.

843,962. PLASTER HOLDER FOR OUTLET BOXES; Adnah McMurtrie, New York, N. Y. App. filed June 14, 1906. The back of the box has sheet metal clips screwed thereon and which are embedded in the plaster surface to which the box is attached.

843,979. SURGICAL EYE MAGNET APPLIANCE; Julius B. Wantz, Chicago, Ill. App. filed Nov. 24, 1906. Form of support for a magnet designed to be used for extracting iron particles from the eye. Has an adjustment by which it may be positioned for different heights in operation.

843,981. INDUCTION-MOTOR; Edward J. Willis, Richmond, Va. App. filed Nov. 9, 1905. An induction-motor having a slotted stator running-coils of relatively large wire disposed within the slots of said stator, starting-coils of relatively small wire also disposed within the slots of said stator, and means for throwing said starting-coils into or out of series with the running-coils.

843,998. TELEPHONE HOOK-SWITCH; Charles C. Cadden, Cleveland, O. App. filed Mar. 15, 1905. Details of construction of hook switch having spring blade contacts similar to those of spring jack.

844,009. ELECTRIC SYMPATHETIC OR SECONDARY CLOCK FOR INDUCTION CURRENTS; Martin Fischer, Zurich, Switzerland. App. filed July 24, 1901. The escapement is controlled by a magnet operated release which is polarized so as to respond alternately to currents in different directions.

844,010. CLOCK CONTROLLED BY REVERSALS OF ELECTRIC CURRENT; Martin Fischer, Zurich, Switzerland. App. filed Sept. 1, 1904. Relates to modifications of the same in which the escapement is controlled by two separate detents which are adapted to be alternately moved by a polarized relay magnet energized by currents in alternate directions.

844,018. PROCESS OF UTILIZING MARL, MAKING CARBID; Herman L. Hartenstein, Constantine, Mich. App. filed Apr. 17, 1905. The process of utilizing marl in the manufacture of carbid, which consists in mixing marl with carbonaceous material, and subjecting the mixture to the fusing or melting action of the electric current, as and for the purpose set forth.

844,044. ATTACHMENT PLUG; Johann G. Peterson, Bridgeport, Conn. App. filed Jan. 7, 1907. A cut-out plug having metallic sockets to receive the metallic jacks or connections which form the terminals of the circuit wires. The sockets are slotted or cut away on one side to receive blade springs.

844,045. ELECTRIC SWITCH; James C. Pinkerton, Philadelphia, Pa. App. filed May 9, 1906. A pneumatic electric switch particularly adapted for use in connection with air brake and steam compressor plants. Has a spring impelled piston and mechanical connections therefrom to operate the switch blade.

844,080. ELECTROCAPILLARY APPARATUS; James T. Armstrong and Axel Orling, London, England. App. filed Mar. 21, 1905. A U-shaped tube contains mercury and another tube having a capillary orifice contains acid and dips into the mercury tube. The two tubes are included in an electric circuit and the movement of the mercury column is indicated by a beam of light.

844,086. TELEGRAPHIC PICTURE TRANSMITTING MECHANISM; Edouard Belin and Marcel Belin, Paris, France. App. filed Dec. 6, 1904. A device for reproducing pictures at a distant point over a single line wire connection. Has synchronously moving parts at the transmitting and the receiving station. The transmitting part makes use of selenium moving in a projected image of the picture to be reproduced.

844,090. AUTOMATIC END CELL SWITCH; Joseph Bijur, New York, N. Y. App. filed Sept. 13, 1905. Has a switch arm moved over the contacts by a pneumatic cylinder.

844,126. SOCKET SEAL FOR ELECTRIC LAMPS, ETC.; Llewellyn T. Hatfield, Sacramento, Cal. App. filed Oct. 4, 1905. A form of seal by which a socket may be closed against the insertion of lamps in cases where a "flat rate" is made and meters are not used.

844,139. INSULATING MATERIAL AND METHOD OF MANUFACTURING SAME; George Kelly, Hinsdale, Ill. App. filed Apr. 24, 1906. The process of making insulating articles which consists in impregnating a material having printer's ink thereon with a vulcanizing paint and vulcanizing the composition.

844,140. INSULATING MATERIAL AND METHOD OF MANUFACTURING THE SAME; George Kelly, Hinsdale, Ill. App. filed Apr. 24, 1906. The process of making insulated articles which consists in disintegrating printer's material, mixing the same with liquid gas and vulcanizing material and finally vulcanizing the same.

844,167. WATER PURIFYING APPARATUS; John McL. Murphy, Danbury, Conn. App. filed Oct. 6, 1906. A vat or tank is partitioned with ordinary plates between which the water passes. These plates are electrically charged so as to electrolytically treat the water.

844,200. CABLE HANGER; Benjamin H. Skinner, Canton, O. App. filed Sept. 11, 1906. A form of metallic strap or ribbon adapted to be passed around a cable and secured thereto and having a loop to receive the messenger cable.

844,208. INSULATORS FOR LEADING IN CABLES, ETC.; Louis Steinberger, New York, N. Y. App. filed Feb. 21, 1906. Insulator adapted to be inset in a brick wall so as to lead a high potential circuit wire therethrough. The insulator has a number of ledges so as to shed moisture and prevent leakage in damp weather.

844,213. ILLUMINANT FOR INCANDESCENT ELECTRIC LAMPS; Orlando M. Thowless, Newark, N. J. App. filed Aug. 13, 1903. In an incandescent electric-lamp, a dense, non-porous current-carrying glower composed of a mixture of rare earths and flux vitrified therewith.

844,240. INDUCTION COIL; Clinton L. Bopp, Hawkeye, Ia. App. filed Oct. 21, 1905. A construction of induction coil having a sectionally wound secondary. Has connections by which alternating or pulsating currents may be obtained from the secondary as desired.

844,257. HARMONIC SIGNALING FOR POLYSTATION TELEPHONE-LINES William W. Dean, Elyria, O. App. filed Aug. 8, 1906. The method of harmonic signaling which consists in tuning the signal-receiving devices to given frequencies and preventing interference by regulating the amount of current of each frequency which may be effectively employed.

844,262. WATER PURIFYING APPARATUS; Albert E. Dieterich, Washington, D. C. App. filed Oct. 3, 1906. A sheet metal casing has partitions by which the water is caused to pass therethrough in a sinuous path. These partitions are alternately charged to positive and negative potential so as to impel an electric current through the water.

844,276. CLUSTER FIXTURE FOR ELECTRIC LAMPS; Syles R. Fralick, Chicago, Ill. App. filed Oct. 26, 1905. Details of con-

844,278.—Telegraph Key.

struction of a cluster socket adapted to receive four or six lamps. Has sheet metal stamped parts by which the connections of all the lamps are made in a multiple circuit.

844,278. TELEGRAPH-KEY; John J. Ghegan, Newark, N. J. App. filed Oct. 18, 1905. Telegraph key designed for high potential circuits. Has an insulating base of plastic material in which is melted a conducting strip so as to secure the most efficient insulation under all circumstances.

844,299. ATTACHMENT FOR TELEPHONE-RECEIVERS; James R. Challen, Collegeville, Pa. App. filed May 12, 1906. The combination of the receiver-cap, the elastic dome having its base against the outer face of said cap and a ring engaging said base portion of the dome and having spurs or barbs whereby it is secured to the apertured central portion of the cap.

844,300. PROCESS OF NEUTRALIZING STATIC ELECTRICITY; William H. Chapman, Portland, Me. App. filed Feb. 12, 1906. The process of neutralizing static electricity in a body consisting of blowing a current of air against said body and placing in said air-current before it reaches said body a conductor charged with electricity of the opposite polarity to that contained in the body.

844,304. METHOD OF COATING LACE WITH METAL; John A. Daly, Washington, D. C. App. filed Oct. 15, 1901. The method of coating lace with metal which consists in covering the threads of lace with a conductor, then electrically depositing metal thereon, solidifying the metal by mechanical action, and finally further electrically depositing a metal coating.